JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

AND

MECHANICS' REGISTER.

AUGUST, 1840.

Practical and Theoretical Mechanics and Chemistry.

Arts and Artisans at Home and Abroad: with sketches of the progress of Foreign manufactures. By JELINGER C. SYMONS, Esq., *one of the assistant Commissioners on the hand-loom inquiry, &c.*

[CONTINUED FROM PAGE 10.]

Facts from the Factories, and Sketches of the Produce in Switzerland and Austria.

Switzerland.—The following was the number of spindles (almost all mules) in the cotton factories of Switzerland in May, 1836, when a census was taken:—

Canton de	Zurich,	292,916
"	St. Gall,	78,570
"	Glarus,	40,100
"	Schwyz,	5,760
"	Thurgovie,	26,400
"	Argovie,	123,536
"	Berne,	10,000
"	Bale,	31,400
		608,682

Since that period, from 30,000 to 40,000 spindles have been put into activity; and there are at this time mills building, in the neighbourhood of St. Gall chiefly, which, when completed, will contain from 100,000 to

150,000 more, so rapid is just now the increase in the cotton-spinning trade of Switzerland. I have visited many of the Swiss mills and likewise of the Scottish mills, and I can distinctly state, that in no respect are those of later origin in Switzerland inferior to those of Scotland. The water-power is of course invaluable, and gives an advantage of which it is not easy to over-estimate the value. The Swiss mills are generally of less magnitude than the English or Scotch mills. At Uznacht there is a splendid new mill, belonging to a company, driving 24,480 spindles, just erected, of four stories, containing 100 windows on each side. It is fitted up in first-rate style, and is remarkable for its cleanliness and airiness. It has an unceasing supply of water from a mountain torrent, which descends immediately behind it. The largest mills are those at Windisch and Turgi, with 35,000 spindles each, belonging, the former to Henry Kemtz, and the latter, to the Brothers Bebie. The average number of spindles in the Swiss mills is not above 1000 spindles, but that is including a great number of very small ones, which drive from 100 to 200 each. From 2000 to 6000 are the commonest number of spindles in a mill.

The average prices of the yarn (mule twist) are as follows:—

	s.	*d.*
No. 40, good second quality,	1	0
" 40, best second,	1	2
" 40, first quality,	1	3
" 60, good second quality,	1	5
" 60, best second,	1	6½
" 60, first quality	1	8
" 70,	1	7½
" 70,	1	9½
" 70,	2	0
" 80,	2	0
" 80,	2	2
" 80,	2	3

Upwards of 40,000 cwt. of raw cotton is consumed in the canton of Zurich alone, mostly spun into Nos. 30 to 50, though up to No. 130 are spun in small quantities. About one-seventh of the cotton tissues are printed. The total number of individuals engaged from first to last in the cotton manufactures, is but little short of 20,000. A large importation of English yarns from Nos. 80 upwards, finds its way to this and the neighbouring canton of St. Gall.

The numbers spun are mostly under 80s, but I have lately seen some excellent yarn of No. 120s spun in one of the Swiss mills, and I believe that the preparations making to spin it extensively for the muslins will succeed. Indeed with English engineers to assist them, it is difficult to see how they can possibly fail.

I am as confident as of any opinion I ever entertained, that at no distant period the English yarn, at any rate those under 150s, will find no market in Switzerland; and that of that portion now sent there to be thence smuggled into other countries, a very large portion will be supplied by Switzerland.

Mr. Wegermann, of St. Gall, told me, that they had little doubt of soon exporting cotton twist, and that they had already made the experiment at Leipsig with great success, realizing a fair profit. Mills are now erecting which will spin 160s.

The only great disadvantage they possess in Switzerland, is higher priced iron; as to fuel, they enjoy an exemption from it altogether, from the abundance of water power. Whatever disadvantages remain to be deducted, on the score of carriage of the raw material, &c., are balanced by the rate of wages being at least one-third below the average in Lancashire. Machine-making is advancing rapidly in perfection, and the aptitude of the work-people is advancing in improvement; but when these elements in the race are matured, I do not believe that, after the carriage is added, our yarn will find any sale in Switzerland.

There are several cotton-spinning mills in Argovia.

The prices of this production have fallen considerably here as elsewhere. No. 40s chain (mule twist) was sold in 1813 in Arau for 7 fr. 20 cent. per English lb. It is now 1 fr. 60 cent. per lb. The reduction has been thus in far greater proportion than even that of the cost of the raw material; for, in 1813, cotton wool of medium quality, was 300 fr. per quintal, and now costs 108 fr. per quintal. The reduction in the price of twist having been in double proportion, proves the advance made in the aptitude of the workmen, and the perfection of machinery: though cotton-spinning was at one period (1828) threatened by the opposition of the working classes, who, (where one-fourth of the whole population vote) have the government of the canton entirely in their own hands. In 1830, the labouring classes opposed themselves with renewed vigour to the cotton mills, and two years afterwards some outrages were committed. The power of education triumphed, however, over the narrow prejudices on first-sight impressions, which alone countenance doubts as to the benefit to the people of increased machinery. The people themselves recognized the truth of the great principles which demonstrate the inseparable identity of their own interests with the abundance of those productions which constitute the wealth of a nation, and necessarily regulate the labourer's share. The labouring classes (themselves the legislature) have enacted laws confirming and promoting the march of machinery.

Woven Goods, or Tissues.—I shall speak of these *seriatim*, and in the same detail as I have reported on them to Parliament, as they are objects of peculiar interest to English manufacturers.

Walkringen is the chief seat of the manufacture of damasks; and, from its growth within a comparatively recent period, there is every reason to apprehend that these articles will eventually hold a first-rate rank among the productions of the Swiss looms. The Messrs. Miescher of Walkringen, and Col. Geisbühler of Berne, were good enough to give me much information as to this branch of industry. From them and others I found that the Bernese table-cloths and napkins, are, by their cheapness, enabled to compete even with those of Belgium. I saw some damask napkins 33 English inches and 2,800 chains in the breadth, a good deal over-wefted, with a pattern about 3 inches square, of which the wholesale price (bleaching included) was 3 fr. per French ounce of 44 inches. They were certainly not so well made as at Courtray or Dunfermline, but were perfectly saleable articles.

A large quantity of trowser stuffs are also manufactured in the same district; some are of duck, others with a mixture of wool, and many striped, chiefly for the South American markets, whither considerable exportations are made. Berne and Langenthal in the Canton of Arau, are the chief markets for the linen webs of the Bernese district.

The wages of the linen weavers are lower, when the price of provisions

is considered, by about 15 per cent. than at Dunfermline, where unions have existed.

Ginghams and ribbons are the chief tissues woven in Argovia.

I was shewn, among a multitude of other articles, a 12^{00} gingham, 30 inches in width, with Turkey red and white check. Chains about No. 20s and weft 40s, overwefted in the proportion of 20 to 17. The weaving of this was 11 fr. for 82 French ells of 44 inches each. Winding and all *et cæteras* paid for by the weaver. The piece of 82 ells, usually woven in a fortnight; gross wages, therefore, on this work would be only 5fr.50 per week (or 4*s.* 7*d.*,) from which winding, say 7*d.*, has to be deducted, together with all the incidental expenses to the weaver of upholding the loom, for which deduct 1*s.* more, leaving 3*s.* per week net wages. The sale-price of these ginghams, wholesale (fast colours,) average about 9*d.* per French ells, or $7\frac{4}{11}$ per English yard; discount 10 per cent.

A sort of striped ginghams are woven here a good deal, for Italian cloaks (stripe in the weft) 12^{00} cram, 45 inches wide. These goods are for printing on. Wages paid for weaving are 27 fr. for 90 ells, of which 6 ells are considered a good day's work; making about 13 fr. 50 cents., or 10*s.* 10*d.* per fortnight, gross wages. Price of these goods wholesale is 2 fr. 50 cent. per ell; discount 10 per cent.

A large branch of the industry of Argovia is devoted to the production of straw and silk articles, chiefly for the Italian and American markets. The wages paid for these do not materially differ from the above. The profits gained in the manufacture of these goods are exceedingly large, owing to improvements of recent date, and the comparative monopoly, as yet, of the trade in the hands of a few manufacturers.

Silk Tissues in Zurich.—Since the fifteenth century the silk manufactures of Zurich have been known to Europe. The manufacture of ginghams and other cotton goods, as well as of worsted and woolens, is also carried on to a considerable extent.

The silks are chiefly plain, and even those which are figured are of a lighter texture than the produce of the Lyonese looms, with which the Zurich manufactures are in direct competition.

At Hausen, which I visited for the purpose of investigating the silk-manufactures in the strong-hold of their fabrication, I collected a great deal of information on the prices of weaving, and the fabrics themselves. I select the following:—

1. Marcellines plain black silk, 18^{00} (*i. e.* having 3600 chains in the width of $37\frac{1}{4}$ inches;) width 31 inches. Wages, 30 fr. for 60 ells. Time, four weeks making, 7 fr. 50 cent. gross wages per week. Wholesale price of these silks, 5 fr. 85 cent. per ell.

2. Gros d'Orleans, 16^{00}, thick warp and weft, width 31 inches. Turin organsine chain, 28 a 30. Milan weft, 28s to 36s. Wages 40 fr. per 60 ells; average period of work six weeks, or 6 fr. 66 cent. gross wages per week; price 8 fr. 60 cent. per ell.

3. Florentine plain white silk, 18^{00}, (or 3600 chains in $37\frac{1}{4}$ inches;) 22 inches wide, single wefted (*tramé à un bout.*) Weight of weft for whole piece, 2 livres 2 ounces; do. do. or chains of organsine, 30 ounces. Wages for whole piece, 15 fr.; time necessary on average to complete it, nearly 3 weeks; giving average gross wages 5 fr. per week; selling wholesale price, 2 fr. 80 cent.

4. Serge, (silk) thin and fine, 22 inches wide, vary 8 fl. or 20 fr. for 52

ells; woven in 3¼ weeks, or 23 days' labour; making 17½ sous per day, or 5 fr. average per week. Price 3 fr. 50 cent. per ell.

5. Green Florentine, 18°°, single wefted, 17 inches wide. Wages 9 fr. for 500 ells, requiring 2 weeks' labour, and giving average of 4 fr. 50 cent. gross wages per week; price 2 fr. per ell.

The beams are all warped by the manufacturer. The number of individuals employed in the silk manufacture cannot be estimated at less than 14,000. Improvements are constantly making in the texture, body, and designs of the fancy goods, and it is not improbable that a successful competition will be shortly established with the Lyonese looms in more articles besides the light low-priced silks.

St. Gall is the chief canton for muslins and the finer ginghams. Embroidery is also extensively carried on. I took great pains to ascertain the exact degree in which these several fabrics competed with our own. During my official inquiries in Scotland, I was frequently told of the formidable competition with the Glasgow muslins and ginghams, anticipated from the looms of this canton and the adjoining district; and a large house in the town of St. Gall was named to me, as having offered goods in the Glasgow market, at as low, or lower, prices than they could be produced at there. I obtained an introduction to the house in question. It is one of the largest in Switzerland both for woven goods and cotton twist. I furnished myself with numerous patterns of these muslins and ginghams, from a different establishment, and accurately ascertained the wholesale prices; verifying the statements made to me by the retail prices asked in the shops for the same goods. My opinion is briefly this: There are two sorts of competition between the manufacturers of two countries; first, their competition in either of their own countries; secondly, their competition in *third* countries. *In plain muslins*, though the prices are not greatly different, I am of opinion that Scotland and Lancashire will maintain their ground over Switzerland, in any market in the world; the evenness and finish of the Scottish goods, both books, jaconets, and mulls, are decidedly superior, and will procure for them the preference, I will undertake to say, in any third market, whither the cost of carriage shall not be greater than from St. Gall. But in Switzerland itself, no competition of our goods of any of the descriptions above named can be sustained with the domestic manufactures. In all these articles (except plain muslins) these cantons are unquestionably enabled to meet us, moreover, *in many third markets*. In the article of lappets, which are woven in Scotland for starvation wages, the Swiss complain that they can do nothing against us in Brezils; but in embroideries, which are most beautiful for curtains and drapery, and likewise in the large-flowered coarse muslins for the second class curtains, &c., they beat us both in price and design. In ginghams chiefly, competition is to be dreaded by our manufacturers, and also in sprigged or coloured muslins. In both of these articles, the superiority of Swiss dyes gives a preference to their goods over ours, whenever, as is the case with ginghams and coloured muslins, they can produce them as cheaply as ourselves. In order to give an idea of the evenness of the race in prices, I subjoin a table of the prices of, as nearly as possible, similar articles at St. Gall and Glasgow. I have taken, in each case, the average wholesale prices struck from the returns of different manufacturers in both places.

Articles.	Number of Chains in 18½ in.	Width in inches	Number of Yarn	How Wefted.	Price per Yard.	
					St. Gall.	Glasgow.
			Ch. W.		s. d.	s. d.
Gingham	16⁰⁰	30	70s. 80s.	3 shots over	0 7	0 7½
Do.	18⁰⁰	30	80 90	equal	0 7¾	0 8½
Imitation cambric	20⁰⁰	35	100 115	1 shot over	1 0	0 11
Mull Muslin	12⁰⁰	35	100 115	3 shots over	0 11	0 8½
Do.*	15⁰⁰	35	160 175	do.	1 0	0 11½
Figured muslin for window curtains	18⁰⁰ 90 flower lash	46	130 145	do.	1 8	1 10
Coloured lappets	15⁰⁰	36	100 110	1 shot over	0 7½	3 9 for 10 yds.
Common muslin checks	14⁰⁰	35	100 110	2 shots under	0 5½	0 6½
Coloured striped muslins, turkey-eyed	14⁰⁰	36	95 100	do.	0 7	0 8½
Strong cotton stripes†	16⁰⁰	20	40 45	do.	with red 4d. without 3¼	....
Pullicates, turkey-red	12⁰⁰	30 by 28	50 55	1 shot over	4*s.* 2*d.* per doz.	4*s.* 3*d.* per doz.

* These articles are prepared and stiffened like book-muslins; the yarn from England.

† These (called Printannieres) were formerly purchased in the Scottish and English markets, but are now made in large quantities in St. Gall for the Levant, America, and Italy.

A Scotchman has been recently engaged by one of the first houses in St. Gall, to superintend the finishing of book-muslins, and the clear finish will be introduced forthwith.

They appear to manufacture articles with great taste for the Italian mar-

kets. I saw some common pullicates, very dark colours, mostly 14⁰⁰, 34 inches square, to which an appearance resembling silk had been given by the hot cylinder; they were sold at 3 florins 20 kreutzers the dozen, and large sales were, I know, effected in them.

The system of manufacturing in these districts is somewhat peculiar. The merchant is not, as in Scotland, also the manufacturer; there is a middle man between him and the weaver, who sometimes receives the yarn from the merchant, and returns him the goods woven. This personage is called the *fabricant;* he makes his own terms with the weavers, to which the merchant is not privy, and generally lives among them. As this man has his own profit to make, the wages paid for weaving are extremely low, and are as nearly as possible the same in money as those of Scotland. The average wages of adults, who work twelve and thirteen hours per day, do not exceed from 5*s.* to 6*s.* weekly, though on the finer work 7*s.* or 8*s.* may be made.

Manufacturing industry is already well developed in the canton of Glaris, and its extension is commencing in the Grisons.

In Glaris, not only are three cotton-spinning mills in the process of erection, but the weaving of the various sorts of cotton articles in St. Gall, and even for St. Gall merchants, is of considerable extent.

The Grisons is a canton hitherto remarkable more from the produce of its pastures than its looms. Nevertheless, manufacturing industry has taken root there, and, as far as cotton-spinning goes, I think it likely that, in twenty years' time, no canton will surpass it, if its natural advantages, both in respect to abundance of iron, and water, and wood, be made available.

At Bale, the ribbon manufactures are flourishing, and a brisk competition is kept up with St. Etienne.

There are not less than 15,000 persons in this and the neighbouring cantons who work for Bale manufacturers, and to whom, generally, the looms belong of those weavers who work in the town of Bale, living themselves in the suburbs. The necessity of preserving the privacy of patterns, renders it necessary to work in factories.

The other Manufactures of Bale, such as hosiery, printing cottons, &c., have entirely declined.

In Austria, the fabrics woven are nearly all sorts of cotton goods, but chiefly of the coarser descriptions.

Wages vary from 7*d.* to 1*s.* 6*d.* per day. A girl will easily earn 36 kreutzers (1*s.*) per day; and food being remarkably cheap, a weaver can live on 20 kreutzers (7*d.*) per day with great comfort, and a girl on 16 or 18 kreutzers.

The cottages and homes of the weavers indicate no poverty, though they are by no means either so clean or so comfortable as those of Switzerland; nevertheless, few are without a garden, and most of the weavers quit the loom not unfrequently for outdoor or other employment.

Mr. Kennedy, in a letter which I have recently received from him, states:—

"There are 4000 looms in this province, a number which has been ascertained officially; but what with the interruptions occasioned by cultivating the land, going to markets, &c. &c., I conceive they do not deliver more than 3000 pieces a-week; and as they have abundance of occupation, they must be exceedingly well treated, or they leave their work."

Cotton-spinning is greatly encouraged by the Austrian Government, who

have afforded this manufacture a protecting duty on our cotton twist of 15 florins on 123 lbs. English weight, about 3d. a lb. This duty added to the carriage, would prevent any English twist from entering Austria, were it not that the Austrian manufacturers choose to keep up their prices, and to realize a profit of about 11 or 12 per cent.; with less than which they would not be content. Thus the protecting duty protects them in fleecing the consumers. I had this from Mr. Kennedy himself. Accordingly, the weaving manufacturers make loud outcry and lamentation; but the spinners are at present too strong for them, and the protecting duty is maintained.

The Austrian Government most rigorously enforces the protecting duty; they make all the Austrian spinners keep a book for the entry of all the yarns spun, and the weavers of all the yarn they buy. This they compare with the imports, and are often enabled to trace the purchase of smuggled yarn to the culprit.

The internal manufactures continually approximate nearer to a total supply of the internal demand, and in the coarser calicoes some exports are taking place.

In woven goods, the Vorarlberg hand-loom weavers are subjected to the competition of those of Bohemia, where wages are much lower, and where the condition of the weaver must be fully as bad as those of Scotland and Lancashire.

In the production of yarn, the same disadvantages attend this industry which I alluded to in Switzerland, namely dearness of iron and distance from cotton marts, but, nevertheless, there is evident scope for larger produce; and the increase which has taken place in this manufacture, evidences its capacity of progress. In 1828, there were 400,000 spindles in Austria; and there are now upwards of 600,000; new mills being also in the course of erection. I extract, from the returns to the Austrian Government, one or two specimens of the productive power of their spinning machinery.

Name of Mills.	No. of Mules.	No. of Spindles.	No. of Yarn spun.	No. of 5 lb. bundles in a year.
			s. s.	
Schloppenhof (Bohemia,)	....	11,520	20 to 130	24,000
Gabel, Riehler's,	4	576	30 to 60	3,456
Schonan (Austria,)	....	25,000	30 to 70	100,000
Bludenz,*	36	5,508	34 average	24,000

The cost of erecting machinery (except to Mr. Escher, who makes it himself) is the greatest drawback. A cotton-mill of 16,000 spindles, I was informed, would cost L.37,000 to erect. From subsequent information, I should be inclined to think L.32,000 nearer the mark; this would be at the rate of L.2 per spindle; whereas, at the ordinary estimate in England of 17*s.* 6*d.* per spindle, such a mill would cost us only L.14,000; considerably less than the half. Cotton wool is brought from Trieste the whole way on the axle. However, the long hours, the low wages compared with ours, the water-power costing nothing, fully compensate for the cost of

* This last mill has been burnt down, and another of 12,000 spindles has been just erected.

erection; and this important branch of industry may be considered to be in a very thriving state.

The Messrs. Kennedy and Escher are erecting fresh mills in Piedmont and Sardinia, and a paper-making establishment at Roveredo; the extent of their enterprise is considerable, and their mills (they have also a power-loom factory nine miles from Feldkirch,) on the Austrian side of the Rhine, combine the markets of Austria and Switzerland; an advantage which could not be combined on the other side of the Rhine.

TO BE CONTINUED.

Bibliographical Notices.

Report to the Senate of the United States on Steam Navigation.

On March 2d, 1840, Mr. Ruggles, on behalf of the Committee on Commerce, submitted a REPORT, for a copy of which we are indebted to the kindness of Senator Preston.

This report, with the appendix, embraces a great variety of very interesting statistical information, and also, the opinions of some of the most skilful and scientific gentlemen of this country and of Europe, on the causes of, and means of avoiding, the disasters incident to navigation by steam.

In reference to the supposed inutility of attempting to regulate steam navigation by law, founded on the argument that, the proprietors of steam-vessels cannot be supposed to neglect any thing which would conduce to the safety of the public, since their own interest would also suffer from such neglect, the Committee very justly remark—

We have had too many proofs of the futility of relying alone on the self-interest of proprietors, or the sense of personal hazard of engineers, for security against steam disasters. Legislative regulations and penalties must, therefore, interpose their protection.

It is acknowledged that steam-travel in this county has been attended with somewhat more hazard than in England: the ascertained and reported number of accidents in England being 92, while those of the United States amount to 272. The difference much exceeds that of the number of steamers employed.

Much of this difference of hazard arises from the peculiar casualties to which steamers are exposed on the Western rivers, from snags and sawyers, and from collision in fogs, or in turning short bends in the rivers. Something, too, may be placed to the account of that racing and reckless propensity which is there subject to less rebuke, even from passengers than it meets with on the Eastern waters. Another reason for it, prolific of disaster, is to be found in the arrangement of the high-pressure boilers in the Western boats, by which the flues are more exposed to become bare of water and overheated while careening at the numerous stopping-places. Out of the 272 ascertained accidents above mentioned, 207 have occurred on the Western rivers, and 65 only on the Eastern waters and the great lakes.

The Committee are of opinion that the law of Congress, passed in 1838, has been of service, but at the same time admit, that it falls far short of shielding the public from those disasters which prompted its adoption.

Within the last year 200 lives have been lost, exceeding the average of former years.

"There were 41 accidents in 1839 on the Western waters alone. The following statistical account of them is derived from a Western publication:

Snagged	21
Struck upon rocks, &c.	7
Destroyed by fire	6
Explosions	4
Collisions	3
	41

Of these, 23 were totally lost. Loss of property estimated at no less than a million of dollars.

Lives lost by explosions	39
By other causes	7
	46

Snagged on the lower Mississippi	11
on the Missouri	4
on the Ohio	4
on the Yazoo	1
on the Red river	1
	21

It is spoken of as remarkable that the majority of the boats were snagged on their downward trips.

Add to these the loss of the Great Western by fire, in Detroit river, new boat, built at a cost of $100,000; the accident on board the Narragansett, on Long Island Sound, in August last, by which several persons were severely scalded (App. C;) the loss of the Lexington, by fire, on the Sound, by which about 150 lives were lost (App. B;) the collapse of a flue of the Erie, on the Hudson river; which, with a few other accidents of less moment, including many fires that were extinguished, but not particularly ascertained, make up the sum of last year's steamboat misfortunes, and furnish ample reason for some more effective legislation."

The steam tonnage of the United States, as registered and enrolled in 1839, is about 200,000 tons, and estimating the average of boats at 200 tons burden, the whole number of steamboats registered and enrolled would be 1000.

"How many there are of a smaller class, not included in the above, employed as ferry-boats, and in other local service in harbours, or as tow-boats, we have no data from which to estimate.

The following classified enumeration of the causes of accidents to steam-vessels will serve to indicate the character of the necesary measures of precaution to be adopted, and direct the application of appropriate remedies:

Explosions, caused by—

1. Bad construction of boilers in respect to form, and being insufficiently stayed.

2. Unsuitable materials used in their construction, and bad workmanship.
3. Using old boilers after being weakened by being corroded, burnt, or strained.
4. Want of sufficient safety-valves, in number and area.
5. Overloading safety-valves on an erroneous estimate of the strength of the boiler.
6. Ignorance, carelessness, recklessness, and *drunkenness* of enginemen and firemen.
7. Suffering the water to get too low in the boilers, from inattention, or want of apparatus to denote the level of the water and the temperature of the steam.
8. Want of steam gauges, or errors in their indication.
9. Inattention to frequent cleansing of boilers of saline and muddy deposites.

Fires, caused by—

1. Placing boilers too near the decks, partitions, and sides of the vessel, without defences of sheet iron, or lining of boiler-room; and having brick walls or other slow and constant conductors of heat resting on or against the woodwork.
2. Want of protection to the decks from overheated flues and chimneys; and defects in the flues, or at the junction of flues and smoke pipes, occasioned by burning or rusting.
3. Fire being blown out of the furnaces into the fire-room, among the fuel and other combustibles.
4. Stowing fuel in the fire-room, and too near the boiler.
5. Dangerous stowage of combustible merchandise, and sparks from the chimney.
6. Incautious using of lights in the private apartments.
7. Deficiency of means of extinguishing fires; and panic and confusion from the consciousness of such deficiency, without boats enough to insure escape.
8. Want of faithful fire-watch.

Wrecks, *snagging* and *foundering*, caused by—

1. Failing of defective boilers and engines.
2. Frail and defective hulls.
3. Want of water-tight bulkheads.
4. Deficiency of sails, and want of cables and anchors.

Collisions, caused by—

1. Want of proper signal-lights.
2. Want of a gong or "steam whistle," in fogs or thick weather.
3. Neglecting to keep a lookout.
4. Want of a defined "rule of the road."

The only practicable mode of reaching these causes of disaster is by means of a compulsory, rigid, scrutinizing inspection of the hull, boiler, engine, and all the equipment of steam-vessels, made by competent and sworn officers; not nominal and formal merely, as is too often the case under the present law, but an actual and faithful inspection."

The strictures of the Committee on the objects which most imperatively claim the attention of inspectors appointed by law, include the following:

Structure of the hull—steam-boilers,—safety-valves,—steam and water gauges, and thermometers,—fire, and means of prevention, and of escape,—

safety boats,—engineers; and the remarks of the Reporters under each of these heads, ought to claim the attention of all the Inspectors.

In reference to the duty of Congress in interposing the strength of its arm in order to arrest the apparently increasing evils, arising, as we must and do believe, in *almost* every instance, from a culpable neglect of the precautions that might be taken, the Committee furnish the following:

"*Summary of the provisions recommended to be made by law.*

1. Steam-vessels not allowed the privilege of enrolment or registry without a certificate of inspection, and payment to the collector, if the vessel be under one hundred tons burden, of $10; if between one and two hundred, $15; if between two and four hundred, $20; if over four hundred, $30.

2. A system of compulsory, thorough, and faithful inspection of the hull, boiler, machinery, and all equipments of the vessel and engine to be made by inspectors appointed by the district judges, and to hold their appointment four years, unless sooner removed.

3. Inspectors empowered to examine witnesses under oath on the construction of the hull and engine, and touching any matter of which it is their duty to inquire; to discriminate between vessels adapted to lake and sea, and those adapted only to river navigation; to inspect the hull annually; to test the boilers by hydrostatic pressure semi-annually, and oftener if necessary; may examine, on request of passengers, and to certify positively the results of their inspection; to determine and certify the maximum pressure to which the steam may be raised, not to exceed one-third of the test pressure; and also the minimum height of water, below which it may not be exhausted; to notify when a vessel becomes unsafe to transport passengers; to examine and license engineers, annually, and to revoke licenses for intemperance, neglect of duty, or misconduct; to report, annually, to the Secretary of the Treasury, the number of steam-vessels inspected, and the particulars of their equipments and condition, and particulars of accidents; to receive from the collector of the district $20 for the annual inspection of each vessel and equipments, and $15 for all other inspection of each during the year, and to receive from each engineer examined $5.

4. Steam boilers to be tested at three times the pressure allowed as a maximum; the boilers to be provided with a mercurial steam-gauge, thermometer, and glass water-gauge, or a water-float, protected by a curb from agitation and foaming, with index showing the height of the water; gauge-cocks to communicate with a tube within the boiler; boilers to have two safety-valves of approved area—one to be inaccessible to the engineer, except to raise it, to be loaded by the inspectors at the maximum pressure; the other at halfway between the maximum and the common working pressure.

5. The indications of the steam and water-gauges to be exhibited in view of the passengers, in a conspicuous part of the vessel, showing, on a scale, the pressure of steam and height of water the engine is working under.

6. Hand force pumps for injecting water into the boiler on failure of engine pump, or obstruction in the injection-pipe.

7. The boiler rooms to be made fireproof inside by a lining of sheet-iron, forced half an inch or more from the woodwork; the decks around the smoke-pipes to be similarly protected.

8. Steamers to have two or more effective fire engines, double force pumps, or rotary pumps, one on the forecastle and the other aft, drawing water by suction-pipes through the bottom of the vessel, and hose to each to convey water to any part of the vessel; also, forty buckets, with bailing-ropes attached; and axes; and two or more tanks on the promenade-deck, holding not less than three hundred gallons, to be kept filled with water.

9. Lake, sound, and sea-going steamers, to have an equipment of sails; and safety boats sufficient to carry all the passengers and crew—one-half, at least, in capacity, to be life-boats. River steamers under one hundred and seventy-five tons, to have boats to carry at least forty persons; over one hundred and seventy-five tons, boats to carry seventy persons.

10. Metallic tiller chains or rods to be used instead of ropes, except so much as passes round the tiller-wheel; the chain to be capable of being disengaged at the stern; and a spare tiller to connect with the head of the rudder-post.

11. At night a white light to be elevated forward, and a red light aft; the former twelve feet above the upper deck, the latter three feet lower; to have a steam safety pipe, to be sounded every half-minute in fogs or thick weather.

12. As "a rule of the road," steamers meeting "stem on," to starboard their helms, and pass to the left, except that in rapid rivers the ascending steamer shall have the preference of the inshore slack water and eddies; the descending steamer the preference of the current. Steaming vessels meeting sailing vessels, to pass to the windward, yielding the course and giving good berth to the sailing-vessels, whatever may be the direction of the wind.

13. Engineers to be of two classes—chief engineers and sub-engineers; to have license from the inspectors, after examination into their competency and skill, sobriety, and good moral character; none others to be employed. Every boat to have one chief engineer, and a competent number of sub-engineers. Certificate of inspection, and of examination of engineers, to be posted up on board.

14. Sea, sound, and lake going steamers, not to carry gunpowder. Steamers on rivers emptying into the Gulf of Mexico and their tributaries, not to carry gunpowder except in iron chests, and notice thereof to be posted up on board.

15. The putting on board of any sailing-vessel or steam-vessel, gunpowder, secreted in other merchandise, disguised, or falsely marked, or without information to the master, to be punished as a misdemeanor, and powder forfeited.

16. Inspectors punishable for giving certificate without examination, or for certifying knowingly what is not true.

17. All duties enjoined to be enforced by penalties.

18. Any person employed on board of steamboats, by whose negligence or misconduct the life of any passenger shall be destroyed, to be considered guilty of manslaughter, and punished by imprisonment.

19. For carrying excess of steam, or working the water below the point prescribed, penalty and forfeiture of wages.

20. Owners and masters to be considered as common carriers, and liable as such; and all agreements and notices to the contrary made void.

21. The fact of injury to person or property on board by steam, fire, or collision, to be *prima facie* evidence of negligence; and owners liable

for the wilful misconduct as well as the negligence of those in their employment.

A compliance with regulations of the foregoing description cannot be attended with great expense to the owners of steam-vessels; certainly in no degree commensurate with the advantages to be derived in the security they will afford to human life. The proprietors themselves, it is believed, will find their own pecuniary interest subserved thereby, in securing a greater degree of public confidence in steamvessels, and a consequent increase of patronage, as well as in lessening the hazard attending this species of property, and affording them the benefit of a diminished rate of insurance."

The committee, therefore, report a bill embracing the foregoing provisions.

In the first page of the appendix we have the following valuable statistics of the amazing extent of this new and Herculean power; and while it reminds us of the extraordinary animation and zeal with which we have heard the great pioneer into this new world of wonders (Robert Fulton) dilate upon the prospects which his success and his confidence were unfolding to the visions of his wakeful and energetic mind, we cannot but believe that his revelations fell short of the reality. His opinion was, that steam would effect a most beneficent revolution in the navigation of the father of rivers and its accessible tributaries. That the epoch of this change should have so soon and so fully arrived, is an evidence at once of the astonishing enterprize of the inhabitants of the great valley of the Mississippi, and of the energy of character which the power of steam is prone to elicit.

We find by the table that great as is the steam tonnage of New York and a few other states, the single port of New Orleans enrolls nearly one-third of the whole of the United States.

"*Statement showing the amount of steam tonnage of the United States registered and enrolled, as returned by the several collectors on the 30th September*, 1839.

DISTRICTS.		Registered Tonnage. Tons and 95ths.	Enrolled Tonnage. Tons and 95ths.
Waldoboro',	Maine	"	67.53
Bath,	"	"	575.14
Boston,	Massachusetts	"	2,243.10
New Bedford,	"	"	57.01
Nantucket,	"	"	171.20
Providence,	Rhode Island	"	487.00
Newport,	"	"	211.11
Middletown,	Connecticut	"	796,29
New London,	"	"	346.45
New Haven,	"	"	784.10
Fairfield,	"	"	291.70
Vermont,	Vermont	"	1,364.42
Sackett's Harbor,	New York	"	896.80
Oswego,	"	"	629.20
Genesee,	"	"	139.00
Oswegatchie,	"	"	508.62
Buffalo Creek,	"	"	4,916.00

Seam tonnage Continued.

DISTRICTS.		Registered Tonnage. Tons and 95ths.	Enrolled Tonnage. Tons and 95ths.
Sag Harbor,	New York	"	29.87
New York,	"	"	30,348.57
Perth Amboy,	New Jersey	"	498.47
Newark,	"	"	291.55
Camden,	"	"	1,136.57
Philadelphia,	Pennsylvania,	"	8,424.55
Pittsburg.	"	"	11,864.71
Wilmington,	Delaware	"	373.60
Baltimore,	Maryland	360.31	7,754.83
Annapolis,	"	"	336.42
Georgetown,	Columbia	"	1,123.35
Alexandria,	"	"	984.16
Norfolk,	Virginia	"	1,209.85
Richmond,	"	"	147.70
Wheeling,	"	"	2,268.74
Charleston,	South Carolina	74.00	2,984.05
Savannah,	Georgia	2,217.87	4,294.91
Brunswick,	"	"	408.03
Miami,	Ohio	"	1,801.30
Cuyahoga,	"	"	3,917.46
Sandusky,	"	"	2,272.67
Cincinnati,	"	"	9,159.47
Detroit,	Michigan	"	3,160.17
Mobile,	Alabama,	236,54	3,714.06
Louisville,	Kentucky,	"	8,125.87
St. Louis,	Missouri	"	9,735.00
Nashville,	Tennessee	"	4,240.94
New Orleans,	Louisiana	2,314.93	61,213.67
Appalachicola,	Florida	"	1,559.67
Total	.	5,203.65	194,365.94

Recapitulation of the steam tonnage of the United States.

	Tons—95ths
Employed on the Eastern waters . . .	54,473.59
Employed on the lakes	341.27
Employed on the Western waters (rivers) . .	108,923.58
Employed south of the Potomac river . . .	17,831.15
	199,569.59

The appendix contains the testimony taken before the coroner and jury relative to the burning of the Lexington—with a description and strong recommendation of Francis' Life Boats. We also find in it abstracts of the laws and regulations of foreign states respecting steamboats. Those of France we think it right to copy:

France.

Cast-iron boilers prohibited.

High-pressure boilers to be proved by the hydraulic press, to at least three times the degree of pressure at which it is intended to use the steam. The owners to find the press and labour.

Rectangular boilers exempted from proof when used to raise low-pressure steam, *i e.*, steam not exceeding 7 lbs. pressure per square inch above the atmosphere.

All cylinders, and cylinder jackets of steam-engines, whether using high or low steam, to be proved to three times the working pressure.

The above rules apply to all engines and boilers, whether employed on land or water. The following are special laws as to steam-vessels:

1. No steamer to ply until certified to be seaworthy in hull, boilers, and machinery; to undergo subsequent inspection every three months.

2. No certificate granted, but on the express condition of the engineman being a skilful mechanic, and possessed of sufficient knowledge to maintain the machinery in good order, and repair it if necessary. No fireman allowed to act as engineman, but to be subject to the order of the latter. The engineer to observe precautionary rules, to be hung up for his guidance in the engine room.

3. Every boiler to be provided with a water float and index, two glass water-tubes, three gauge-cocks, and an open-ended mercurial steam-gauge. It is also recommended to apply a safety-pipe, with a whistle at the end of it, to give notice when the water is too low.

4. Two safety-valves required to each boiler, of not less than a certain area. High-pressure valves to be loaded by means of a lever; low-pressure with a solid weight upon them. All additional weight, after the survey, prohibited. The prescribed pressure stamped on the valve-boxes.

5. Two disks of fusible metal to be fixed on all boilers, in the steam-space or chest, having different degrees of fusibility, and different dimensions; the smallest and most fusible to have an area equal to that of one of the safety-valves; the largest and least fusible to have an area equal to four times that of the valve. These disks are supplied, after proof of the boilers, and according to the pressure at which it is intended to work: all change of them prohibited, and duplicates to be carried in every vessel.

6. Instructions given for the management of the fires, and for the conduct of the engineer and captain reciprocally, when the vessel has to stop, &c.

7. The captain to be personally responsible for all accidents arising from excessive velocity; and owners, for all accidents which may arise from the non-observance of the laws and regulations.

8. A ruled log-book, or diary, to lie open in the cabin, in which passengers are requested to write their observations concerning the events of their journey and the performance of the vessel: these books to be examined by the police authorities and commissioners on their periodical visits. In the cabin is to be placed a table, indicating—

1. The mean duration of a trip.
2. The time allowed for stoppages.
3. The maximum number of passengers permitted by the law.
4. The right given to passengers to inscribe their remarks in the log-book.

9. The minutiæ of the *procès verbaux* by the commissioners, &c., are particularized.

10. Tables of the elastic force and temperature of steam, from 1 to 50 atmospheres of pressure, are given, together with the areas of safety-valves and fusible disks proper for each pressure, as determined by a commission of the Royal Institute."

The appendix is enriched with a valuable mass of "extracts and communications addressed to the British Commissioners of Steamvessels," constituting more than half of the document issued by the Senate. Our limits will not admit of extracts from them, but of their value to all who are concerned in the business of steam craft we have a high opinion. G.

Rail-roads in the United States. By Chevalier De Gerstner.

Rail-roads in the State of Pennsylvania.

The first rail-road in America was constructed in Pennsylvania, and the same State has at present the greatest extent of rail-roads in operation. With the exception of only two lines, all have been constructed by private companies. Some of those established at an early period were designed exclusively for the transportation of coal from the mines to the place of their transhipment. For the construction of these roads little regard was paid to the grades and curvatures; and inclined planes were frequently resorted to. The other rail-road lines, generally of a much greater length, are used for the transportation of passengers and freight. The manner of construction of the different rail-roads in this State is very various, and it is of great interest to follow all the improvements made in this respect since the construction of the Mauch Chunk Rail-road, finished in 1827, up to the present time, when all the experience acquired during 13 years is brought into application; on the Reading Rail-road, for instance. With the exception of some of the oldest coal rail-roads, the tracks have an uniform width of 4 feet 8½ inches, the same as was adopted in England. The superstructure is generally of wood—flat bars upon continuous bearings, or heavy T rails upon wooden cross ties. As motive power, stationary and locomotive steam engines, horses and mules, and gravity, are used.

The following table contains a list of all the rail-roads in the State of Pennsylvania either completed or in progress of construction,* and has been prepared after a personal examination of the different works:

* A. D. 1839.

Rail-roads completed and in progress in the State of Pennsylvania.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded.	No. Miles not yet c'nstr'd	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles			Dollars.	Dollars.	Dollars.	Dollars.
1	Philadelphia & Columbia	Philadelphia to Columbia.	1834	82			82	41 lbs.	36 locomot's	4.000.000		4.000.000	48.780
2	Alleghany Portage,	Johnstown to Holidaysburg.	1834	36¾			36¾	39½ lbs.	17 "	1.850.000		1.850.000	50.450
3	West Chester,	Columb. & Phil. R. R. to W. Chester.	1834	9			9	2¼×⅞	horses	90.000		90.000	10.000
4	Valley,	Columbia & Philad'a. R. R. to Norristown.			10	10¼	20¼						
5	Philad'a., Germantown, Norristown,	Philadelphia to Germantown & Norristown.	1837	20¼			20¼	40 lbs.	8 locomot's				
6	Philadelphia & Reading,	Philadelphia to Mt. Carbon.	1839	54½	15	32½	102	45 lbs.	7 "	2.976.000	1.614.000	4.590.000	45.000
7	Philadelphia & Trenton,	Philadelphia to Trenton.	1833	30			30	2¼×⅞	5 "	400.000		400.000	13.333
8	Philad. & Wilmington,*	Philadelphia to Wilmington.		28			28	2¼×⅞	4 "	500.000		500.000	17.857
9	Harrisburg & Lancaster,	Harrisburg to Lancaster.	1837	36			36	2¼×⅞	8 "	860.000		860.000	23.900
10	Cumberland Valley,	Harrisburg to Chambersburg.		46			46	2¼×⅞	8 "				
11	Franklin,	Chambersburg to Williamsport.	1839	10½	6	7½	24		1 "				
12	York & Wrightsville,	York to Wrightsville.			13		13	58 lbs.					
13	Mauch Chunk,	Mauch Chunk to Coal Mines.	1827	9			9	2×½	mules	100.000		100.000	11.110
14	Room Run,	Near Mauch Chunk to Mines.	1833	5			5	2×½	mules	150.000		150.000	30.000
15	Beaver Meadow,	Beaver Meadow to Parryville.	1836	26			26	2¼×⅞	6 locomot's	360.000		360.000	13.846
16	Hazleton Branch,	Hazleton to Beaver Meadow R. R.	1838	10			10	2¼×⅞	3 "	120.000		120.000	12.000
17	Sugar Loaf Summit,	Branches to Beaver Meadow.	1839	2	2		4	2¼×⅞	1 "	30.000	10.000	40.000	10.000
18	Buck Mountain,	Buck Mountain Coal Mines to Lehigh.			4½		4½	38 lbs.		100.000		100.000	23.077
19	Susquehanna & Lehigh,	Wilkesbarre to Whitehaven.			20½		20½	57 lbs.		600.000	400.000	1.000.000	48.785
20	Little Schuylkill,	Port Clinton to Tamaqua.	1831	22		7	29	2×0.44	5 locomot's	400.000	100.000	500.000	17.241

* The Philad'a and Wilmington Rail-road now forms a part of the Philad'a, Wilmington, and Baltimore Rail-road; the whole of which has cost $4.400.000.

Rail-roads completed and in progress in the State of Pennsylvania—Continued.

Rail-roads completed and in progress in the State of Pennsylvania—Continued.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded.	No. Miles not yet c'nstr'd	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital aready expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles			Dollars.	Dollars.	Dollars.	Dollars.
21	Little Schuylkill & Susquehanna,	Catawissa to Little Schuylkill R. R.			39		39	50 lbs.		850.000	1.000.000	1.850.000	36.275
22	Beaver Meadow Extension,	Little Schuylkill & S. R. R. to Beaver Meadow R. R.			12		12	50 lbs.					
23	Schuylkill Valley,	Port Carbon to Tuscarora.	1830	10			10	$1\frac{1}{2}\times\frac{2}{8}$	horses	65.000		65,000	6.500
24	Mill Creek,	Port Carbon to Coal Mines.	1830	5			5	$1\frac{1}{2}\times\frac{2}{8}$	horses	45.000		45.000	9.000
25	Branches to both,	From different mines.		12			12	$1\frac{1}{2}\times\frac{2}{8}$	horses	54.000		54.000	4.500
26	Mount Carbon,	Mount Carbon to Minehill.	1831	7			7	$2\frac{1}{4}\times\frac{5}{8}$	horses	118.000		118.000	16.857
27	West Branch,	Schuylkill Haven to Minehill and branches.	1831	18			18	$7\frac{1}{2}$&35 lbs.	horses	315.450		315.450	17.525
28	Pottsville & Danville,	Pottsville to Sunbury.	1838	$29\frac{1}{2}$	3	10	$42\frac{1}{2}$	$2\times\frac{1}{2}$&$2\frac{1}{4}\times\frac{5}{8}$	2 locomot's	670.000	200.000	870.000	20.470
29	Williamsport & Elmira,	Williamsport to Pennsylvania State line.	1839	25	1	41	67	$2\frac{1}{2}\times\frac{3}{4}$	1 "	437.000	903.000	1,340.000	20.000
30	Blossburg & Corning,	Blossburg to Penn. State line.			$25\frac{3}{4}$		$25\frac{3}{4}$	$2\frac{1}{4}\times\frac{1}{2}$	2 "	250.000		250.000	9.709
31	Carbondale,	Carbondale to Honesdale.	1829	$16\frac{1}{2}$			$16\frac{1}{2}$	$1\frac{1}{2}\times\frac{1}{2}$&$2\frac{1}{4}\times\frac{1}{2}$	horses and stat'n'ry eng	300.000		300.000	18.182
32	Pine Grove,	Union Canal to Coal Mines.	1830	4			4		horses				
33	Lykens Valley,	Millersburg to Bear Gap Mines.	1830	$16\frac{1}{2}$			$16\frac{1}{2}$		horses				
34	Bear Creek,	Pottsville & Danville R. R. to Coal Mines.			2	2	4						
35	West Philadelphia,	Philad'a. & Columbia R. R. to river Schuylkill.			8	2	10						
36	Philadelphia,*	Within the city of Philad'a.		6			6	$2\frac{1}{4}\times\frac{5}{8}$	horses				
				$576\frac{1}{2}$	$161\frac{1}{2}$	$112\frac{1}{4}$	$850\frac{1}{4}$		114 l'com't's				

* The rail-roads in Philadelphia are:—the City Rail-road, $2\frac{1}{4}$ miles; N. Liberties and Penn Township, $1\frac{1}{4}$ mile; Southwark Rail-road, with branch, $2\frac{1}{2}$ miles.

1. In the whole there are 40 different rail-road lines in the State of Pennsylvania, 2 of which were constructed by the State, and 38 by private companies. The longest continuous line of rail-road now in operation in the State, is that from Philadelphia to Greencastle, a distance of 163 miles; and the total length of rail-roads, which were in use at the close of 1839, is 576½ miles; there were besides 161¾ miles nearly completed, and 112¼ miles to be constructed, making the total length of all the rail-roads in the State, when completed, equal to 850¼ miles.

2. The number of locomotive engines employed for the transportation of passengers and freight in the State of Pennsylvania is 114; they run upon 16 rail-roads with an aggregate length (in operation) of 485 miles, being 1 locomotive engine for 4¼ miles of rail-road. In some of these rail-roads stationary steam-power is also applied.

3. The above statement contains the amounts already expended on 26 rail-roads, and their ultimate total cost; of the other roads the exact amounts have not been ascertained. If we compare the length of these 26 rail-roads, which is 686¼ miles, with their total cost of $19.867.450, we find the average cost per mile $28.950. At a fair estimation, the amount already expended on those works, not comprised in the above 26, and being 164 miles in extent, may be put down at $2.410.000, and their ultimate cost at $3.200.000, we then have:

Total amount expended for rail-roads in Pennsylvania, . .	$18 050.450
Amount yet to be expended on works under construction, . .	5.017.000
Total cost of all the rail-roads, when completed, . .	$23.067.450
And the average cost per mile, " "	27.150

Rail-roads in Virginia, North Carolina, South Carolina, Georgia, and Florida.

The rail-roads in these States are nearly all of a light and cheap construction. They traverse sections of country only very thinly settled yet, and therefore command a very small traffic in the transportation of passengers as well as merchandise. It is, however, a particular advantage to these rail-roads that they form a better system than those in the other States, being nearly all connected together, and forming a great thoroughfare through a large portion of the Union; wherefore they are used by the travellers from the North and North-west to the South and South-west, as also for the conveyance of the great Southern Mail. A continuous, uninterrupted line of rail-road, now exists from Fredericksburg in Virginia, to Wilmington, North Carolina, in the one, and to Raleigh, North Carolina, in the other direction; the former having a length of 304, the latter of 227½ miles. Within a short period, other lines of similar length will be completed.

The *Rail-roads in Virginia* have all wooden superstructures with flat iron bars of small dimensions (generally ½ inch in thickness.) Their grades, however, are very moderate, the country being favorable for their location. The State government has taken an active part in the promotion of rail-roads in Virginia, by subscribing for two-fifths of the stock of all works, as soon as the other three-fifths were subscribed by private individuals.

The State of *North Carolina* has now two extensive rail-roads in operation, one of which forms the longest line of rail-road as yet completed by a single company in the United States. The same rail-road has an uninterrupted straight line of 47 miles in length. The width of track of the rail-roads in this State, as well as in the State of Virginia, is 4 feet 8½ inches.

South Carolina was in possession of one of the earliest rail-roads in America; but although this was completed in 1833, no other rail-road has been undertaken, except the branch to Columbia, which forms the first section of the intended Louisville, Cincinnati, and Charleston rail-road.

The *Rail-roads in Georgia*, though but lately commenced, are beginning to class amongst the most extensive and important. When completed they will form a system by which the whole State must be benefited. One rail-road is constructed by the State, the other lines were undertaken by private companies, to whom banking privileges are granted, in order better to enable them to raise the necessary capital, as also to realise a larger profit by the assistance of banking operations. The rail-roads are substantially built, partly with plate rails, and partly with the heavy T rail.

The *Territory of Florida*, with its small population, is not devoid of rail-roads; they are confined, however, to the western section of the country, where now three rail-roads with an aggregate length of 60 miles, are in operation. They were constructed by private companies. A fourth rail-road, extending into the State of Alabama, has been commenced, but the works on it are at present suspended.

The rail-roads in Georgia, South Carolina, and Florida, have all a clear width of track of 5 feet.

The following list of the rail-roads in the five States enumerated, has been compiled from data collected during the summer of 1839. Corrections have been made concerning those works which have since been progressing, so that this table represents the different works in the state they were in at the close of the year 1839.

Rail-roads completed and in progress in the States of Virginia, North and South Carolina, Georgia, and Florida Territory.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded.	No. Miles not yet c'nstr'd	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles			Dollars.	Dollars.	Dollars.	Dollars.
1	Richmond, Fredericksburg, and Potomac,	Richmond to Fredericksburg and the Potomac.	1837	61½		14	75½	plates 2¼ × ½	12 locomot's	1.200.000	250.000	1.450.000	19.205
2	Richmond & Petersburg,	Richmond to Petersburg.	1838	22½			22½	" 2 × ½	5 "	700.000		700.000	31.111
3	Louisa,	Richmond, Fredericksburg, & Potom'c r. r. to Gordonsv'le.	1838	35	14		49	" 2¼ × ⅞	*	415.000		415.000	8.470
4	Richmond & Coal Mines,	Richmond to the Mines.		12			12	" 2 × ½	*	100.000		100.000	8.333
5	Chesterfield,	Manchester to Coal Mines.	1831	13			13	" 2 × ½	horses	200.000		200.000	15.385
6	Petersburg and Roanoke,	Petersburg to Blakeley.	1833	60			60	" 2 × ½	12 locomot's	766.000		766.000	12.767
7	City Point,	Petersburg to City Point.	1838	9			9	" 2 × ½	1 "	210.000		210.000	23.333
8	Greensville and Roanoke,	Petersburg and Roanoke R. R. to Gaston.	1838	17⅔			17⅔	" 2 × ½	*	260.000		260.000	14.717
9	Portsmouth & Roanoke,	Portsmouth to Weldon.	1837	78½			78½	" 2¼ × ½	7 locomot's	850.000		850.000	10.851
10	Winchester and Potomac,	Winchester to Harper's Ferry.	1836	32			32	" 2 × ½	5 "	500.000		500.000	15.625
1	Experimental,	Raleigh to Stone Quarries.	1833	1½			1½	" 1 × ¼	horses	3.600		3.600	2.400
2	Raleigh and Gaston,	Raleigh to Gaston.	1840	84½†			84½	" 2 × ½	*	1.360.000		1.360.000	16.095
3	Wilmington and Raleigh,	Wilmington to Weldon.	1840	161†			161	" 2 × ⅝	11 locomot's	1.800.000		1.800.000	11.180
1	Charleston & Hamburg,	Charleston to Hamburg.	1833	136			136	25½ lbs.	27 "	2.400.000		2.400.000	17.647
2	Louisville, Cincinnati, & Charleston,	Branchville to Columbia.			50	16	66	56 lbs.		800.000	800.000	1.600.000	23.880
1	Georgia,	Augusta to Madison and branches.	1839	87½	70	54	211½	2.4 × 0.8,46 lbs	10 "	2.178.000	1.000.000	3.178.000	15.026
2	Central,	Savannah to Macon.	1840	100†	30	63	193	2½ × ¾ & 32 lbs.	4 "	1.280.000	1.020.000	2.300.000	11.917

* The locomotive engines used upon these rail-roads belong to other Companies, with whom agreements were made for the purpose.
† These distances stated as opened, were completed early in 1840.

Rail-roads in Virginia, North and South Carolina, Georgia, and Florida—Concluded.

Rail-roads in Virginia, North and South Carolina, Georgia, and Florida—Concluded.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded	No. Miles not yet c'nstr'd	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles			Dollars.	Dollars.	Dollars.	Dollars.
3	Monroe,	Macon to Weston & Atlantic R. R.	1839	24	20	52	96	$2\frac{1}{4}\times\frac{5}{8}$	3 locomot's	600.000	900.000	1.500.000	15.625
4	Western and Atlantic,	Decatur to Ross' Landing.			100	40	140			1.400.000	1.400.000	2.800.000	20.000
1	Tallahassee,	Tallahassee to St. Marks and Port Leon.	1837	22	2		24	$2\frac{1}{2}\times\frac{1}{2}$	2 "	200.000		200.000	8.333
2	St. Joseph and Lake Wimico,	St. Joseph to Bayou Columbus.	1836	8			8	$2\frac{1}{4}\times\frac{1}{2}$	2 "	120.000		120.000	15.000
3	St. Joseph and Iola,	St. Joseph to Iola.	1839	$28\frac{1}{2}$			$28\frac{1}{2}$	$2\frac{1}{2}\times\frac{3}{4}$	1 "	500.000		500.000	17.544
4	Alabama, Florida, & Georgia.	Pensacola to Montgomery.‡			15	$141\frac{1}{2}$	$156\frac{1}{2}$	$2\frac{1}{2}\times\frac{3}{4}$	2 "	600.000	2.400.000	3.000.000	19.169
23				994	301	$380\frac{1}{2}$	$1675\frac{1}{2}$		104 locom's	18.442.000	7.770.000	26.212.000	15.644

‡ Only about 40 miles of this rail-road are in Florida, the remainder in Alabama.

From this statement the following table is extracted, showing the number of miles of rail-roads undertaken and completed, as also the capital expended, and the whole cost of the rail-roads in each of the five States:

Name of State.	No. of Rail-roads.	No. miles in operation.	Total length of roads.	No. of locomotives.	Amount of capital expended.	Am't necessary for completion.	Total cost of Rail-roads.	Average cost per mile.
Virginia, . .	10	369	341	42	$5.201.000	$250.000	$5.451.000	$14.772
North Carolina, .	3	247	247	11	3.163.000		3.163.000	12.806
South Carolina, .	2	202	136	27	3.200.000	800.000	4.000.000	19.802
Georgia, . .	4	$640\frac{1}{2}$	$211\frac{1}{2}$	17	5.458.000	4.320.000	9.778.000	15.266
Florida Territory, .	4	217	$58\frac{1}{2}$	5	1.420.000	2.400.000	3.820.000	17.604
	23	$1.675\frac{1}{2}$	994	102	$18.442.000	$7.770.000	$26.212.000	$15.644

The number of locomotives in use upon 994 miles of rail-roads is only 102, being at an average one locomotive engine for every 9¾ miles of rail-road, a circumstance which serves to indicate comparatively small traffic upon these roads. But the last column in this table at the same time shows that the cost of the construction of these rail-roads is smaller in proportion, so that a moderate income will suffice to give a good interest on the capital invested. It must also be remarked that the charges for transportation are higher in the southern than in the northern States.

The average cost per mile of all the 23 rail-roads when completed, will be $15.644, according to the estimates of the engineers, which in some cases may be exceeded; but even if a sufficient allowance be made for this, the average cost per mile will not rise over $16.000.

Rail-roads in Alabama, Louisiana, Mississippi, Tennessee, and Kentucky.

The rail-roads in these five States also pass more or less through sections of country very thinly settled, and are with some exceptions of a less substantial construction, and with the limited means of the companies, the time of their completion may yet be far distant.

The rail-roads undertaken in *Alabama* appear very extensive, if the small population of this State be taken into consideration. Only one of the lines, however, that from Decatur to Tuscumbia, has been opened.

The rail-roads in *Louisiana* are all very short, with the exception of the New Orleans and Nashville rail-road; they nearly all terminate at some point on the Mississippi river, and like the rail-roads in the adjoining State of Mississippi, form lateral branches to this great highway of the West.—To some of the rail-road companies in Louisiana, loans were granted by the State, while others have obtained bank charters.

In *Mississippi* the rail-roads are constructed at a considerable expense by companies with banking privileges. The longest line is that from Natchez to Canton.

Two rail-roads are in progress in the State of *Tennessee*, but no part of them has yet been opened; and in *Kentucky* only 32 miles of rail-roads are in operation. In the latter State a considerable sum has been expended for the improvement of rivers, turnpike roads, and the Louisville and Portland canal.

The rail-roads in *Alabama* and *Louisiana* have not an uniform width of track; on most, however, it is 4 feet 8½ inches. The New Orleans and Nashville rail-road has a clear width of 5 feet 6 inches. The width of track of the railroads in *Mississippi* is 4 feet 10 inches.

Rail-roads completed and in progress in the States of Alabama, Louisiana, Mississippi, Tennessee, and Kentucky.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded.	No. Miles not yet constr'd	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles.			Dollars.	Dollars.	Dollars.	Dollars.
1	Montgomery and West Point,	Montgomery to West Point.			65	20	85	plates $2\frac{1}{2}\times\frac{3}{8}$		200.000	700.000	900.000	10.590
2	Wetumpka and Coosa,	Wetumpka to Fort Williams.			35	21	56	"		50.000	566.000	616.000	11.000
3	Selma and Tennessee,	Selma to Gunters' Landing.			27	143	170			80.000	1.570.000	1.650.080	9.700
4	Cahawba and Marion,	Cahawba to Marion.			27		27			50.000			
5	Linden and Demopolis,	Linden to Demopolis.			10	12	22			25.000			
6	Mobile and Cedar Point,	Mobile to Cedar Point.	1837	5	4	$17\frac{1}{2}$	$26\frac{1}{2}$	" $2\times\frac{5}{8}$	1 locomot.	117.000	183.000	300.000	11.320
7	Tuscumbia, Courtland, and Decatur,	Decatur to Tuscumbia.		46			46		2 "				
1	Pontchartrain,	New Orleans to Lake Pontchartrain.	1831	$4\frac{1}{2}$			$4\frac{1}{2}$	24&56 lbs.	4 "	356.000		356.000	79.110
2	New Orleans and Nashville,	New Orleans to Mississippi State line.	1839	$22\frac{1}{2}$		66	$88\frac{1}{2}$	$3\times1\frac{1}{8}$	3 "	970.000	800.000	1.770.000	20.000
3	Bath,	New Orleans & Nashville R. R. to Lake.	1837	$1\frac{1}{4}$	2	$2\frac{3}{4}$	6	$2\times\frac{3}{8}$	horses	50.000			
4	Carrolton,	New Orleans to Carrolton.	1837	$7\frac{1}{4}$			$7\frac{1}{4}$	$2\frac{1}{2}\times\frac{1}{4}$	5 locomot's	500.000		500.000	68.965
5	Orleans Street,	In New Orleans.		$1\frac{1}{2}$			$1\frac{1}{2}$	$2\times\frac{1}{2}$	horses				
6	Lake Borgne,	New Orleans to Lake Borgne.	1838	5		20	25	$3\times1\frac{5}{8}$	1 locomot.				
7	Alexandria and Cheneyville,	Alexandria to Cheneyville.	1839	6	10	14	30		2 "				
8	Baton Rouge & Clinton,	Baton Rouge to Clinton.				30	30			16.000			
9	Clinton & Port Hudson,	Port Hudson to Clinton and Jackson.	1839	14	14		28	$2\frac{1}{2}\times\frac{7}{8}$	3 "	400.000	100.000	500.000	17.857
10	West Feliciana,*	Bayou Sara to Woodville.			20	8	28	$2\frac{1}{4}\times\frac{3}{8}$	2 "				
1	Mississippi,	Natchez to Canton.	1839	25	15	100	140	40 lbs.	4 "	1.550.000	1.950.000	3 500.000	25.000

* $7\frac{1}{2}$ miles of this rail-road are in the State of Mississippi.

Rail-roads in Alabama, Louisiana, Mississippi, Tennessee, and Kentucky.—Continued.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded.	No. Miles not yet c'nstr'd	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles.			Dollars.	Dollars.	Dollars.	Dollars.
2	Vicksburg and Jackson,	Vicksburg to Jackson.	1839	25	20		45	42 lbs.	4 locomot's	1.600.000	160.000	1.760.000	39.111
3	Jackson and Brandon,	Jackson to Brandon.			12		12			30.000			
4	Raymond,	Vicksburg R. R. to Raymond.			6		6	2×$\frac{5}{8}$		30.000	20.000	50.000	8.333
5	Grand Gulf & Pt. Gibson,	Grand Gulf to Port Gibson.			7	½	7½	50 lbs.					
1	Hiwassee,	Knoxville to Georgia S'te line.			70	27	97						
2	Lagrange and Memphis,	Lagrange to Memphis.			40	10	50	2½×$\frac{5}{8}$					
3	Sommerville Branch,	Lagrange & Memphis R. R. to Sommerville.			10	3½	13½	2½×$\frac{5}{8}$		200.000	300.000	500.000	7.874
1	Lexington and Ohio,	Lexington to Portland.	1835	30½	27	37	94½	2½×$\frac{5}{8}$	2 locomot's	935.000	1.250.000	2.185.000	23.122
2	Portage,	Bowling Green to Barren riv.	1837	1½			1½	2½×$\frac{5}{8}$	horses	12.000		12.000	8.000
27				195	421	532½	1148½		33 locomot's				

This statement does not contain the cost of every rail-road in progress, and the amount which has already been expended, because of some it was difficult to obtain correct data, on account of the lines being located in remote parts of the States, while others have yet made very little progress, and their ultimate cost is therefore hardly known. In the following table, which contains the aggregates for each State, the deficiencies were made up by estimates founded upon a knowledge of the nature of the works and their plan of construction.

Name of State.	No. of Rail-roads.	No. miles in operation.	Total length of roads.	No. of locomotives.	Am'nt of capital expended.	Am't necessary for completion.	Total cost of Rail-roads.	Average cost per mile.
Alabama, . .	7	51	432½ miles.	3	$1.222.000	$3.434.000	$4.656.000	$10.763
Louisiana, . .	10	62	248¾ "	20	2.862.000	1.834.000	4.696.000	18.880
Mississippi, . .	5	50	210½ "	8	3.490.000	2.240.000	5.730.000	27.221
Tennessee, . .	3		160½ "		1.100.000	855.000	1.955.000	12.180
Kentucky, . .	2	32	96 "	2	947.000	1.250.000	2.197.000	22.885
	27	195	1148½ miles	33	$9.621.000	$9.613.000	$19 234.000	$16.750

It appears that there are 27 rail-roads in the above five States, of which only 195 miles are completed and in operation, while their total length, when finished, will be 1148 miles. 33 locomotive engines are used upon 195 miles of roads, which gives one engine for 6 miles; the greatest number of locomotives is upon the Pontchartrain rail-road, that is, 5 for $7\frac{1}{2}$ miles, or 1 for $1\frac{1}{2}$ miles of road.

Of the total cost of the rail-roads, which will be $19,234,000, one-half has already been expended, and only one-sixth of the whole length is in operation. This shows that the works on many rail-roads must have been suspended, when they were already far progressed. The average cost of the rail-roads in these five States will be $16,750 per mile, which does not differ much from the cost of the rail-roads in Virginia, North and South Carolina, Georgia, and Florida.

Rail-roads in Ohio, Indiana, Michigan, and Illinois.

Ohio has early embarked in a system of internal improvements, but following the example of the State of New York, has chosen canals to form the artificial lines of internal communication through this large State. Several rail-roads were long afterwards undertaken by private companies, whom the State assists by guaranteeing loans to the amount of one-third the cost of the works. Passing through a flat country, and intended to accommodate only a small traffic, the rail-roads in Ohio are constructed on a cheap plan, but are nevertheless progressing very slowly, owing to the difficulty of providing the necessary funds. For the Ohio rail-road, which is to extend along the shore of Lake Erie, a width of track of 7 feet has been adopted: the other rail-roads have the usual width of 4 feet $8\frac{1}{2}$ inches.

In *Indiana* the internal improvements are, like the canals in Ohio, undertaken at the expense of the State, and consist in a system of canals, turnpike roads, and one rail-road, leading from the capital of the State to the Ohio river. This rail-road is constructed in a very permanent manner. Another along the northern boundary line of the State has been commenced by a company, but the works were afterwards suspended for want of capital.

Michigan, though one of the youngest States, will soon have all the settled parts of the country traversed by rail-roads, which are partly constructed by the State and partly by private companies. The country is very favourable for the location of rail-roads, and they are therefore executed at a very moderate cost.

The system of rail-roads projected in *Illinois* is far too great for the present population, trade, and resources of this young State, and it will be long before all the rail-roads projected and under construction will be completed. Besides the State works, only two rail roads have been undertaken by private companies, one of which has been completed; of the other, the works are suspended. The width of track of the rail-roads both in Michigan and Illinois, is 4 feet $8\frac{1}{2}$ inches.

The data for the following statement has been collected during the months of August and September, 1839, and as very little has been done from that time to the end of the year, the numbers have been left unaltered.

Railroads completed and in progress in the States of Ohio, Indiana, Michigan and Illinois.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded.	No. Miles not yet c'nstr'd	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles			Dollars.	Dollars.	Dollars.	Dollars.
1	Mad River & Lake Erie,	Sandusky City to Springfield.	1838	15	30	85	130	plates $2\frac{1}{4}$ × $\frac{3}{8}$	1 locomot.	155.000	755.000	910.000	7.000
2	Little Miami,	Cincinnati to Springfield.			20	65	85	$2\frac{1}{2}\times\frac{3}{4}$		100.000	900.000	1.000.000	11.765
3	Monroeville & Sandusky,	Monroeville to Sandusky City.	1838	15			15	$2\frac{1}{4}\times\frac{2}{8}$	horses	75.000	15.000	90.000	6.000
4	Cleveland and Newburg City,	Cleveland to Stone Quarries.	1838	6			6	wooden ribbon.	horses	18.140		18.140	3.023
5	Fairport and Painsville,	Fairport to Painsville.	1838	3			3		horses	22.000		22.000	7.333
6	Ohio,	Conneaut to Maumee Bay.			30	147	177	$2\frac{1}{2}\times\frac{3}{4}$		50.000	1.189.000	1.239.000	7.000
1	Madison & Indianopolis,	Madison to Indianopolis.	1839	20	30	40	90	rails 45 lbs.	2 locomot's	1.300.000	2.200.000	3.500.000	38.839
2	Buffalo and Mississippi,	Western to Eastern Boundary of the State.			10	146	156			75.000	1.225.000	1.300.000	8.333
1	Erie and Kalamazoo,*	Toledo to Adrian.	1836	33			33	plates $2\frac{1}{4}\times\frac{2}{8}$	2 "	281.000	19.000	300.000	9.091
2	Palmyra & Jacksonburg,	Palmyra to Jacksonburg.	1838	11	5	30	46	$2\times1\frac{1}{8}$	horses	53.000	246.000	299.000	6.500
3	River Raisin and Lake Erie,	Monroe to Lake Erie.	1838	4			4	wooden ribbon.	horses	44.000		44.000	11.000
4	Detroit and Pontiac,	Detroit to Pontiac.	1839	18	7		25	$2\frac{1}{4}\times\frac{2}{8}$	1 locomot.	160.000	40.000	200.000	8.000
5	Shelby and Detroit,	Detroit to Utica.	1839	10		7	17	wooden ribbon.	horses	23.000	17.000	40.000	2.353
6	Ypsilanti and Tecumseh,	Ypsilanti to Tecumseh.			5	19	24			40.000	160.000	200.000	8.333
7	Detroit and Maumee,	Manhattan to Havre.			3		3			15.000	5.000	20.000	6.667
8	Central,†	Detroit to St. Joseph.	1839	38	30	128	196	$2\frac{1}{4}\times\frac{5}{8}$	5 locomot.	800.000	1.552.000	2.352.000	12.000
9	Southern,†	Monroe to New Buffalo.			50	139	189	$2\frac{1}{4}\times\frac{6}{8}$		420.000	1.659.000	2.079.000	11.000
10	Northern,†	Point Huron to Grand Haven.			10	$191\frac{1}{2}$	$201\frac{1}{2}$	$2\frac{1}{4}\times\frac{5}{8}$		60.000	1.955.000	2.015.000	10.000

* 12 miles of this rail-road are in the State of Ohio.

† These 3 rail-roads are State works.

Rail-roads in Ohio, Indiana, Michigan, and Illinois—Continued.

Rail-roads in Ohio, Indiana, Michigan, and Illinois—Continued.

No.	Name of Rail-road.	From and to where.	Opened. Year.	Opened. Miles.	No. Miles besides graded.	No. Miles not yet c'nstr'd.	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
							miles.			Dollars.	Dollars.	Dollars.	Dollars.
1	Central,	Cairo to Galena.			85	365	450	$2\frac{1}{4}\times\frac{3}{4}$		400.000			
2	Northern Cross,	Quincy to State line of Ind'a.	1839	16	100	114	230	"	2 locomot's	785.000			
3	Peoria and Warsaw,	Peoria to Warsaw.			24	92	116	"		140.000			
4	Bloomington and Mackinaw .	Pekin to Bloomington.			10	$26\frac{1}{2}$	$36\frac{1}{2}$	"		75.000	14.007.500	15.768.000	12.000
5	Southern Cross,	Alton to Mount Carmel.			30	117	147	"		150.000			
6	Alton and Shawneetown,	South Cross to Shawneetown.			15	130	145	"		75.000			
7	Alton and Shelbyville,	Alton to Shelbyville.			15	93	108	"		45.000			
8	Central Branch,	Shelbyville to State line of Ind.			20	$51\frac{1}{2}$	$71\frac{1}{2}$	"		90.000			
9	Rushville and Erie.	Rushville to Erie.				10	10	"		500			
10	New Pittsburg and Mississippi,‡	Illinois Town to Coal Mines.	1838	7			7	$2\times\frac{1}{2}$	horses	42.000		42.000	6.000
11	Galena and Chicago Union,‡	Galena to Central Rail-road.			4	96	100			30.000	1.170.000	1.200.000	12.000
29				196	533	$2092\frac{1}{2}$	$2821\frac{1}{2}$		13 locomot's	5.523.640	27.114.500	32.638.140	11.568

‡ These two rail-roads are constructed by private companies; all the others are State works.

The following table gives a summary statement of the works in each of the four Western States.

Name of State.	No. of Rail-roads.	No. miles in operation.	Total length of roads.	No of locomotives.	Amt. of capital expended.	Amt. necessary for completion.	Total cost of rail-roads.	Average cost per mile.
Ohio,	6	39	416 miles.	1	$ 420.140	$2.859.000	$3.279.140	$ 7.883
Indiana,	2	20	246 "	2	1.375.000	3.425.000	4.800.000	19.512
Michigan,	10	114	$738\frac{1}{2}$ "	8	1.896.000	5.653.000	7.549.000	10.222
Illinois,	11	23	1421 "	2	1.832.500	15.177.500	17.010.000	11.970
	29	196	$8221\frac{1}{2}$ miles.	13	$5.523.640	$27.114,500	$32 638.140	$11.568

Of the 29 rail-roads in the States of Ohio, Indiana, Michigan, and Illinois, only 196 miles have been completed and put into operation; of these, 56 miles are used with horse power, and 140 miles with locomotive engines; each locomotive serves, therefore, for 11 miles of rail-road. When all the rail-roads projected and commenced in the above four States will be completed, their aggregate length will be 2,821½ miles.

The total amount already expended on all the 29 rail-roads is $5,523,640, and near 5 times as much, or $27,114,500, will be required, according to the estimates, to complete the works; the total cost being estimated at $32,638,140, or only at $11,568 per mile at an average. This cost appears very low compared with that of other rail-roads; but with the experience already acquired in the construction of these kind of works, and where the country offers so few obstacles to their location, there is no doubt that rail-roads with wooden superstructure and plate rails may be executed for the sum of $12,000 per mile.

Franklin Institute.

Report on Mr. L. Phleger's Spark Arrester.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination an apparatus for arresting sparks issuing from the flues of locomotive engines, invented by Mr. L. Phleger, of Philadelphia, Penn., REPORT:—

That they have examined this apparatus, and witnessed its operation on some of the engines of the Philadelphia and Baltimore Rail-road, where it has been on trial for several weeks.

It consists of several parts, the arrangement of which will be described with as much detail as is essential to the object of this report. Around the smoke-pipe of the engine which is of the usual form and dimensions, is placed a case of sheet-iron perforated with some thousands of small holes, resembling those of a fine nutmeg grater with the burr turned inwards. This case is sufficiently large to leave a space of two inches width between it and the smoke-pipe, and rises several inches above the top of the pipe: it is closed at the top by an inverted conical cap of thin cast iron, which is fixed on a hinge and furnished with a lever and rod, by which it may be raised out of the way when the fire is first kindled, for getting up steam. Outside of the perforated case just described is a second casing of sheet-iron, not perforated, but furnished with twelve out-let pipes about six inches diameter, six of which pass out at its base, and after two bends, or elbows, are again inserted at its top: the other six are similarly inserted at the top of the outer case, but have their lower insertion within about 12 or 15 inches of the top.

The annular chamber between the two cases, is open at the top for the ultimate escape of the smoke and vapour.

When the smoke and cinders are thrown up the smoke-pipe by the power of the exhaust, they strike against the conical cap which closes the top of the perforated case, and rebound into the annular space between it and the enclosed pipe, with great velocity. The smoke and other gases from their small momentum, soon lose a part of their downward motion and are forced out through the numerous perforations, which present an aggregate area of

passage much greater than the section of the smoke-pipe, and thus give free vent to the gases. The cinders having a greater density are carried downward by the joint effect of their momentum and gravity, until they are beyond the effect of the exhaust, and are finally shaken by the motion of the engine into an iron receptacle connected with the annular space in which they have been deposited.

The smoke and steam, with some of the fine particles of dust, having passed through the perforated case, enter the annular chamber between the two cases, and are mostly carried to the bottom of this by the portion of their directive force which they retain. From this they escape by the six longer out-let pipes described as proceeding from the base of the chamber and are given out at the top of the chimney; the small sparks, if any escaped through the perforated case, having been extinguished, or deposited in the circuitous course through which they must travel.

This circumstantial statement of the action of the apparatus is given, because at first view of it not much confidence was placed in the probable result; but repeated trials having proved its complete efficiency, it was deemed worth while to examine minutely into the mode of its operation, and give a brief description of it in this report.

The trials in the presence of the Committee were made under a variety of circumstances, well calculated to remove all uncertainty of the entire correctness of their observations. On the first occasion they traveled behind the engine from Elkton to Gray's Ferry, a distance of 45 miles, entirely after night. On the journey down to Elkton they were conveyed by an engine provided with a spark arrester of some other form, whose it was they did not learn, but it may suffice to say of it, that the route was enlivened after night-fall, by a copious shower of brilliant cinders, which were scattered many yards to the lee side of the road, notwithstanding a heavy rain which was falling at the time.

On returning with the apparatus which is the subject of report, they were agreeably surprised to find that while the engine was running with the fire door closed, not a single spark made its appearance. When the engine was standing, or when the fire-door was opened, a few sparks were seen to escape, but their number was so small as to be easily counted, and they were so light that they were extinguished, or burned out before passing half across the road. A subsequent trial was made in the presence of some members of the Committee, when both engines, going and returning, were furnished with this apparatus, so as to give an opportunity of witnessing its effect by day and by night; the result on this occasion was equally satisfactory as on the former.

As the Committee have had some experience of the operation of spark arresters, and have generally found, heretofore, that they were efficacious only in proportion as they impeded the fire draught, it was deemed important to inform themselves particularly on this point, in the present case. On enquiry of the engineers who are using the apparatus, they agreed in asserting that the engines made steam quite as well with it as without, and some of them supposed even better. The engines used on these trials were drawing their usual train on a full trip, and certainly made abundance of steam, blowing off during a considerable part of the trip; and an examination of the fire when the furnace door was opened, showed that the effect of the exhaust was not perceptibly diminished.

In conclusion, the Committee feel entirely free to state their conviction, that the experiments witnessed by them were completely successful, and if

farther trials made with heavy trains shall give similar results, and the apparatus is not found to become impaired in its efficiency, by the choking up of the perforations, as has been the case with some others in which the perforated sheet has been used, they believe it will constitute the long-sought desideratum of an efficient machine which completely removes all danger and inconvenience from the chimney sparks, while it does not sensibly diminish the power of the engine.

By order of the Committee.

WILLIAM HAMILTON, Actuary.

August 13, 1840.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JULY, 1839,

With Remarks and Exemplifications by the Editor.

1. For *Hanging Scythes;* Ebenezer G. Samson, Shelburn, Franklin county, Massachusetts, July 2.

A considerable number of patents have been granted for this mode of attaching scythes to their snaths, and no doubt the manner of effecting this has been much improved; but the wedges, keys, or rings, by which it is effected are not matters to be spread forth on our pages, as without a cut they would not be rendered intelligible; the claims in the present case are to the particular manner in which a hook, a bolt, and a claw, are used, to accomplish the desired object.

---

2. For *Coffins made of Cement, &c.;* Moses Leonard, Syracuse, Onondaga county, New York, July 2.

The claim is to the making of coffins of a resinous cement which is to be poured into moulds properly constructed, there being cores of thin boards, perforated, or formed of slats, in such a manner as to cause the cement to bind perfectly, and also to cover the edges of the wood completely. The particular manner of forming these moulds is also claimed.

"My cement, or composition, I make as follows:—I take rosin, beeswax, and pulverized stone, which I incorporate intimately by heat. The stone may be limestone, marble, granite, or any other of a suitable hardness and texture; the pulverized stone I prefer to make of different degrees of fineness, from that of corn-meal, to that of grains of buckwheat. To five pounds of rosin and one of beeswax, I add about thirty pounds of the pulverized stone, first melting the rosin and beeswax in an iron vessel over a fire, and stirring in the pulverized stone, previously sifted; and these ingredients in their proportions, or nearly so, will constitute a cement, or bituminous artificial stone which, whilst it may be fused and cast into moulds, will, when cold, be extremely hard and tough, and perfectly impervious to air and moisture."

---

3. For an improvement in *Coffee Mills;* John Rittenhouse, Germantown, Philadelphia county, Pennsylvania, July 2.

The kind of mill on which this improvement is made is the common box-mill, with a conical nut and shell, and the design of the improvement

is to confine the nut in such a manner as shall prevent the danger of the teeth of the nut and shell coming into contact with each other. For this purpose the pin of iron that forms the step in which the spindle of the nut runs, is to be made in the form of a cross, and notched on to the shell, which will prevent its shifting in either direction. The claim is to the "so forming such a step as that it shall have three or more distinct points of bearing; or bear upon the whole, or the larger portion of the lower edge of the hollow cone, or shell, the bearings being so notched, or formed, as to check all lateral motion."

---

4. For a *Smut Mill*; Elisha W. and W. B. Young, Parkman, Geauga county, Ohio, July 2.

In this smut machine there is a revolving wheel, or a vertical shaft, which wheel consists of two pieces of plank, about two feet six inches in diameter, and standing at a distance of three inches apart. Numerous rods of iron extend from one to the other of these planks, and the grain is fed in between them, through an opening in the centre of the upper plank, and by the centrifugal force given to the wheel the grain strikes against these rods, and against a perforated sheet-iron curbing which surrounds the wheel. Below the lower plank there are cones to create a blast to aid in the cleaning. The grain falls down and is discharged through a funnel-formed hopper below. The claim is to "the wheel constructed as described, in combination with the perforated screen."

---

5. For *Separating Burrs from Wool;* Henry Conklin, Poughkeepsie, Dutchess county, New York, July 6.

This machine consists, principally, of a large iron roller which may be of cast-iron, six inches in diameter and 15 inches long; of certain small rollers, called pinching rollers, which are borne together in pairs, and hold the wool between them and the larger roller; and of a plate of metal called a detainer, one edge of which is nearly in contact with the large roller, its office being to detain, or keep back, the burrs from passing; there are also plates of tin, the edges of which rest upon the rollers, to prevent the lapping of the wool around them. The claim is to "the combination of the longer roller, the detainer, and the finishing rollers, constructed and operating substantially as set forth."

---

6. For a *Cheese Press;* Odin Gauntt, Springfield, Burlington county, New Jersey, July 6.

In this press the gravity of the cheese to be pressed is made the operating power, as in some other presses for the same purpose; but the parts are arranged differently in the press before us, and this difference becomes the foundation of the claim. The cheese rests upon a platform, which is a follower, and makes a part of a sliding frame which rises and falls between the cheeks of the press. The arrangement is not made known by the claim, nor could this be done without the drawings.

---

7. For a *Wire Tiller Rope;* Isaac McCord, Harrisburg, Dauphin county, Pennsylvania, July 6. (See specification.)

8. For a *Door Latch;* Henry Duntze, New Haven, Connecticut, July 6.

A peculiar arrangement of the spring-bolt, follower, friction roller, and spiral spring has been made by the patentee, and no doubt constitutes a good spring-latch; but it is less simple than many others, while we see nothing to render it superior to them. The claim is to "the follower, provided with a friction roller, in combination with the bolt and tumbler, as described."

---

9. For a machine for *Manufacturing Crackers and Biscuits;* Benjamin F. Mason, Kennebunk Port, York county, Maine, July 6.

"In this machine the flour and water, with such other materials as may enter into the composition of the crackers, or biscuits, are put into a suitable mixing apparatus, or dough-maker and brake, in which they are thoroughly intermingled, made into dough, and the dough properly broken; from this apparatus said dough is delivered into a hopper, and thence conducted between pairs of rollers, by which it is rolled out to the desired thickness. It is then cut into square or other formed biscuits, by the aid of a cutting roller, and also at the same time pricked, or perforated with holes. By this cutting roller and its fellow, or antagonist roller, the biscuits are delivered on to an endless, revolving, iron apron, by which they are carried into and through a perpetual oven, kept heated by suitable furnaces; in their passage through which oven they are baked and ready to be packed for use."

It will be seen by the foregoing announcement of the general plan and object of this machine, that the whole series of operations concerned in the making of biscuits, is to be simultaneously carried on by it. Many of the individual parts are necessarily similar to such as have been used, but they appear to be combined and arranged with much skill; and if the baking and other operations can be all performed with corresponding speed, we see no reason why the apparatus should not effect the intended purpose advantageously.

---

10. For a *Carriage Brake;* Cyrus Walker, Lewisburg, Greenbrier county, Virginia, July 8.

This brake is to operate by forcing a friction bar against the hind wheels of a carriage, the foot of the driver being placed upon a treadle for that purpose. The affair does not present a large amount of novelty, but it differs from other brakes in the particular arrangement of the rods and levers, and this constitutes what is claimed.

---

11. For *Metallic Hubs for Carriages;* George Hunt, Prattsville, Greene county, New York, July 8.

The claim under this patent is to "the mode of securing the pipe box of the hub to the arm of the axletree, by means of a band attached to the flanch of the axletree, embracing the flanch on the pipe box, as described."

On the inner end of the box there is a projecting flanch, or rim, which comes nearly into contact with the shoulder, on the head of the axle. The band mentioned in the claim is fastened to the head of the axle by a screw bolt, and a flanch, or fillet, on the interior of this band, embraces the shoulder on the box, and holds it in place, leaving it free to revolve.

12. For a machine for *Drilling Iron, Brass, &c.;* J. H. Currier and W. H. Taber, Fairhaven, Bristol county, Massachusetts, July 8.

A mandrel carrying the drill, works in collars within which it can slide back and forth horizontally. A lever of the first kind is attached to an upright rising from the bore of the machine, the lower end of which is received between two collars on the mandrel, so that by the motion of the lever the mandrel may be moved in either direction. A screw passes through the upper end of the lever, and is tapped into the upright, but not into the lever, within which it turns freely, having a shoulder that bears against it. There is a hand wheel on the head of this screw, by which it may be turned, and a winch on the back end of the mandrel, by which it, also, may be made to revolve. This constitutes the whole machine, which may be affixed to a bench, or held in a vice. The claim is to "the method of forcing in and drawing out the drill stock, lever, and screw, in the manner described." There is, we suppose, sufficient novelty in this arrangement, but we do not think the plan an improvement on several other machines which we have seen in operation.

---

13. For an improvement in the machine for *Cutting Shingles, &c.;* Jonathan Burt, Sullivan, Madison county, and Erasmus Smith, Norwich, Chenango county, New York, July 9.

The claim is to "the manner in which we have constructed and combined the parts by which the stuff to be cut is fed up to the knife, and canted so as to produce shingles of the proper slope;" which method is particularized, but is much too complex for verbal description. It is managed with much ingenuity, and will probably operate well. The shingles, &c., are to be cut from steamed timber.

---

14. For a *Truss for Hernia;* William B. Day, Village of Hope, Warren county, New Jersey, July 9.

"I use a steel spring to pass around the body, and to sustain the pads, as in many other trusses; but this spring, instead of passing around below the hips, is to pass around above them, and is to be furnished with a pad at each end, one of which pads is to press upon the back, and the other upon the abdomen, thus bearing upon parts where a considerable degree of pressure can be borne with much greater ease and convenience than in the ordinary mode of constructing and using spring trusses.

"To the metallic plate which forms the exterior of one of these pads, a second spring is attached, which descends down therefrom, and has a third pad on its lower end, which third pad is the hernial, or rupture, pad, by which the pressure is to be exerted, which is to retain the intestines in place."

Claim. "What I claim as my invention is the manner in which I have combined the back, the abdominal, and the rupture pads with each other, so as to constitute an instrument essentially new in its leading characteristics; that is to say, the abdominal and back pads being attached by a single screw, or joint pin, to the opposite ends of a spring which is to pass around the body above the hips, and the rupture pad being placed at the lower end of a spring descending from the abdominal, or the back pad, as the case may be, said second spring being made adjustable on the plate to which it is attached, in the manner, and for the purpose, set forth."

15. For a *Corn Sheller*; William R. Parker, Milton, Sussex county, Delaware, July 9.

The ears to be shelled are to be placed lengthwise in a hopper, beneath which revolves a cylinder, furnished with teeth, and having a groove along it, into which a single ear may fall; this is carried round against a concave, and to a second cylinder similar to the first, by which the shelling is completed. The cylinders are grooved, or channeled, around, so as to appear like a succession of flat wheels, and within these channels there are fingers which operate upon the ear. The particular arrangement of the parts does not admit of ready verbal description; it is certainly novel, and we suppose that the machine will operate well. There are, however, many excellent corn shellers, leaving little to desire in this way. The claims are to the manner of constructing the cylinders, with their channels and grooves, in combination with the hopper and concave.

---

16. For *Manufacturing Cordage;* Alfred Hathaway, Boston, Massachusetts, July 9.

This is a machine for twisting and laying cordage of various sizes, and in its general construction and operation, it closely resembles several machines which have been patented here and in England; this resemblance is confessed, but the parts claimed consist in a variety of improved devices for obviating difficulties experienced in all the machines heretofore constructed for the same purpose. There are three sheets of drawing, and ten pages of description and references in the record, which we shall not attempt to epitomize; nor shall we give the claims, as they would not, without the other parts, afford a knowledge of the nature of the invention, or rather of the particular improvements upon which it is founded.

---

17. For an improvement in the *Horse Power*; Moses Davenport, Phillips, Somerset county, Maine, July 10.

This patent is taken for a "method of connecting the slats of the endless chain horse power; or in the peculiar power given to the connecting links that may extend up any required distance beyond the surface of such revolving endless chain, to work as cogs into a ratchet wheel of any required diameter." The method of connecting the slats, and of causing a drum, or cog wheel, to carry them round, has been the subject of numerous patents, and in a great number of cases, the advantages of the change patented were not by any means apparent. We do not think it worth while to attempt an explanation of the plan now before us, and the claim is necessarily confined to what is special in this place.

---

18. For *Elliptical Steel Carriage Springs*; Franklin Hatch, and Jonathan W. Terry, South Courtland, Courtland county, New York, July 10.

Two bow springs are jointed together at their ends, so as to form the ordinary, so called, elliptical spring, and within these two, other bow springs are placed, with their convex sides towards each other; these are joined together at their middles, whilst their ends bear against the interior of the first named springs.

"What we claim as our invention, and desire to secure by letters patent,

is the addition of two leaves to the inside of the elliptic spring, with the curves reversed, in the manner herein described."

19. For *Separating Uncorroded from Corroded Lead*; Edward Clark, Saugerties, Ulster county, New York, July 11.

In manufacturing white lead, it becomes necessary to separate the particles of uncorroded lead from that which has been converted into white lead, and this has been found to be a difficult and injurious operation when performed by the means hitherto essayed. The apparatus and process employed by the patentee consist in passing the partially corroded lead on an endless wire or canvas cloth apron, under a whipper, the quick and violent operation of which upon it, separates the carbonate of lead from the metallic lead. The whipper consists of a frame covered with wire cloth, or in some similar manner; this frame is jointed at one end to the frame of the endless apron, and it is worked up and down by cams and springs, so as to operate upon the lead as it passes along on the endless apron. The entire machine is inclosed, to confine the dust, and prevent its deleterious effects. The claim is to "the separation of the corroded parts of the lead from the metal, during the process of manufacturing white lead, by means of the apparatus described, consisting of the endless cloth in combination with the spring whipper."

20. For a *Plough*; Ebenezer G. Whiting, Racine county, Wisconsin Territory, July 11.

"The nature of my invention and improvement consists in making the mould board straight and flat from the point to about the centre, instead of concave as heretofore, and at this point to cause it to assume a curvilinear figure in the usual or most approved pattern, by which union of the straight and curvilinear surface in the mould board, less power will be required to draw it through the earth, and the sward will be turned over smooth and even, without breaking it into pieces." The claim is to this manner of construction.

21. For an improved *Cotton Gin;* John Beath, city of Boston, July 12.

A good roller gin for long staple cotton, has long been considered a desideratum, and the attempts to supply it have been numerous. The machine before us is for this purpose, and it contains some new devices intended to aid in the operation. There are vibrating combs employed, which are to operate upon the bolls of cotton as they approach the rollers, the intention of which is to open them a little, not so as to injure the staple, but only to cause its more easy separation from the seed by the action of the rollers. The claims are to a comb, as described, vibrating horizontally, by means of a winding, grooved pulley; and to the combination of what is called a lowering roller, with a second roller; the particular arrangements we cannot undertake to give in our brief notice.

22. For *Supplying Locomotives with Water*; Stephen Vail, Morristown, New Jersey, July 12.

The following extract from the specification, in which the references to the drawings are, of course, omitted, will furnish a clear idea of the nature of the invention:

"My invention is intended to dispense with the reservoir now used at those stations where locomotive engines are to take in their supply of water, into which the water has, usually, to be pumped by hand, at great labour; and in which, in cold weather, its temperature is frequently reduced considerably below that of ordinary well water. This object I accomplish by applying the power of the locomotive engine to work a pump, or pumps, raising water from a common well, and supplying the tank therewith, by merely driving the locomotive on to the lateral track, where it is to receive its supply of water, and allowing its driving wheels to rest on two friction wheels affixed to a line shaft situated in a pit prepared for that purpose below the track, the peripheries of said friction wheels extending up to the line of the rails, and passing through openings therein, prepared for that purpose. I move the locomotive by means of chains, or other suitable contrivances, so that it shall stand steadily with the peripheries of its driving wheels resting on the above named friction wheels, which, when the steam engine is started, will necessarily drive the friction wheels, the shaft of which has attached to it the apparatus requisite for working the pump, or pumps.

"Having thus fully described the nature and object of my invention, and shown the manner in which the same may be carried into operation, what I claim therein, and desire to secure by letters patent, is the within described mode of working pumps for raising water from wells for the supply of locomotive engines, and which mode of communicating power may also be applied to other useful purposes: that is to say, I claim the placing of friction wheels upon a shaft, below the track of a railroad, in such manner as that the driving wheels of a locomotive engine may be made to rest upon their peripheries, and when set in action by the steam engine, will give motion to said friction wheels, and, consequently, to the machinery attached thereto, substantially in the manner, and for the purpose, set forth."

---

23. For machinery for *Twisting Silk*; Oliver Ellsworth, Hartford, Connecticut, July 12.

The improvement here patented consists in "substituting a ring and hook, or querk, in the rim of the bobbin, for the common flier now in use, placed on the top of the bobbin for twisting silk." "I take merely the old bobbin, without the old flier and button, and make, in the upper rim of the bobbin a groove deep enough around the rim to receive a wire; I then make a wire ring in said groove, loose enough to play with perfect ease, and fasten the ends of this wire so as to form a hook, or guide, extending out just enough to receive the silk thread from the bobbin," &c.

"I do not claim the bobbin, the spindle, the ring and hook, or any of the parts separately, as they have long been known. But what I do claim as my invention, and desire to secure by letters patent, is the ring and hook, or querk, in combination with the bobbin, in the manner, and for the purpose described."

---

24. For a *Washing Machine*: Samuel Swett, jr., Portland, Maine, July 12.

The clothes to be washed are folded and placed on a frame, which is moved up and down, by means of a lever, between two fluted rubbing boards, borne up by springs, the whole being contained within a suitable box. The

claims made are to the frame for holding the clothes, in combination with the rubbing boards attached to springs. This washing machine differs sufficiently from those which have been previously patented, to sustain its claim, but, probably, like most of them, after being for a short period the tenant of the wash-house, it will be consigned to the cellar or to the garret. If any thing saves it, it will be the fluted washing boards, which have kept their station longer than any of the other members of the fraternity.

---

25. For *Vents for Barrels, &c.*; Samuel Pike, Brattleborough, Windham county, Vermont, July 12.

This vent is intended to be self acting, the valve which closes it being opened by the pressure of the atmosphere. It may be said to be in the form of a syphon, with very short legs. The longer leg is furnished with a screw, which screws into the upper side of the barrel; the short leg has a valve within it, which, falling by its own gravity, closes the opening into it. When this is in place, and liquor is drawn from the cask, the pressure of the external air will raise the valve, and air will pass in. The claim is to "a vent for tight vessels, furnished with a valve, which opens by the pressure of the air when the liquor is drawn, and shuts by its own weight when the drawing ceases, constructed in the manner, and for the purposes described."

---

26. For *Traps for Catching Animals;* William Biddle, Pittsburgh, Pennsylvania, July 12.

This trap is constructed in a manner bearing considerable resemblance to that patented by Thomas Kell, on the 3rd of March, 1838, and the ends proposed are the same, namely, that the trap, after catching an animal, shall reset itself, or be reset by the animal; that the captured animal may pass along a passage leading to a separate compartment, from which it cannot return, said compartment being so constructed as to be readily detached from the body of the trap. The particular devices, of course, differ from those used in the trap above named, or the present patent would not have been granted. The claims are confined to these particular devices, as referred to by letters on the drawings.

---

27. For an improvement in *Windmills;* Wantsford Evans, Dumfries, Prince William county, Virginia, July 12.

Within a room, erected for the purpose, there is to be a vertical shaft, turning on gudgeons, that is to be surrounded by vanes, against which the wind is to blow; on the sides of the building there are doors, that may be opened or closed at pleasure, so to admit, and to allow an exit to, the wind. On the outsides of the doors there are to be wings, or sails, of cloth, or other partitions placed to direct the wind towards the doors.

"The invention claimed consists in the arrangement of the wings and doors for regulating the current of air."

If this is an improvement on windmills, we should he glad to hear what kind of windmill is inferior to it. But, as we have frequently remarked, *improvement* and *alteration* are often synonymous in the vocabulary of patentees. The mill before us will not, we are sure, supersede the old fashioned mill with vertical sails, nor equal some of the horizontal mills, most of which are poor affairs.

28. For *Obtaining Ice*; Joseph E. Manuel, city of Philadelphia, July 12.

"I erect a series of platforms, one above the other, which are to be so constructed as to constitute reservoirs capable of containing water to the depth of six inches, more or less; the floors of these reservoirs are to be made water-tight; their dimensions and number must be determined by the quantity of ice it may be desired to make; their distance apart should be such as will admit of the collecting the ice, and shoveling it into the vertical hollow trunk which leads down from the reservoirs into the ice house, or other receptacle.

"In using these structures, water is to be admitted into the reservoirs in any convenient manner. Where there are waterworks, as in the city of Philadelphia, or where it can be obtained from any source sufficiently elevated, it will, of course, be allowed to flow in spontaneously."

"I claim the erecting and employment of platform reservoirs, in the manner set forth, said reservoirs being placed one above the other, and being made capable of containing water for the production of ice; and in combination with such a structure, I claim the formation and employment of a hollow trunk, through which the ice may be passed from the respective reservoirs into an ice house, or other receptacle."

---

29. For a machine for *Mortising, Tenoning, and Boring Timber;* James H. Martin and Barnt Richtmyre, Conesville, Schohairie county, New York, July 16.

Such machines as the above named are capable of almost infinite variation in the manner of forming and arranging their respective parts, and it is altogether out of the question to attempt a brief description of them. The specification before us occupies many pages of record, and contains throughout, references to the drawings; the claims are made by referring to these drawings by letters and numbers. The machine may be, and probably is, a very good one, but a number of others might be made equally good, and yet be so constructed as not to interfere with it, or with each other.

---

30. For improvements in the machinery for *Spinning Hemp;* Chas. W. Brown, Roxbury, Norfolk county, Massachusetts, July 16.

Several different improvements are here described, and claimed in the specification of the patent. The first is in the manner of regulating the winding of the yarn, or twist, on the bobbin. The second is in admitting one of the rollers between which the thread passes, to recede from the others, so as to allow the thread to pass freely, should knots or any foreign matter offer any obstruction. The third is in the arrangement of the draw pullies, immediately in front of the neck of the flier, so as to receive the yarn directly therefrom, without previously passing it over a pulley; there are, also, some minor improvements, which could not be designated without reference to the drawing.

Claim. "First, the employment of a right and left screw, the threads of which cross each other, on the spindle of the bobbin, for giving a rectilinear reciprocating motion to the bobbins, as described. Secondly, the method of giving to the spindle the rectilinear reciprocating motion by means of the fork attached to the shaft of the flier, or to the pulley attached to the shaft of the flier, and by which it receives its rotary motion, as described. Thirdly, the arrangement of the double fork, and spring latch, in combina-

tion with the double threaded screw, for the purpose described. Fourthly, the employment of the cam and spring to retain the fork when shifted by the end of the double screw, in the manner described."

Although, in themselves, the devices referred to are not complex, yet as there are, necessarily, throughout the whole specification and claims, references to the drawings, we are aware that the foregoing cannot give more than an imperfect idea of the nature of the improvements.

---

31. For an improvement in *Padlocks, and in Locks of other kinds;* Joseph Nock, city of Philadelphia, (now of Washington,) July 16.

The objects professed to be attained in the construction of these locks, are to secure them from the danger of being opened by a false key, and also of being opened by a blow, given either by accident or design, by which the bolt, or catch, of an ordinary padlock is frequently started, and the lock opened.

There is to be a notch on each side of the bow of a padlock, to which are adapted two catches on what is called an escapement tumbler, and when this tumbler is acted upon by the key, it must be carried to an exact point to allow the bow to be liberated, as otherwise it will be held by one or other of the catches. In other locks the same device may be used, by arranging the parts so as to adapt them to the particular kind to which they are applied. These padlocks are now employed on some of the U. States mail routes, and are to be adopted for the whole as soon as the supply is sufficient.

---

32. For a *Planing Machine;* Freeman Walcott, East Cambridge, and James H. Hutchinson, Boston, Massachusetts, July 16.

This planing machine is in its general mode of operation, like that of the late Mr. Woodworth, but the cutters are double ironed, and the claim is to "the combination of the double iron rotary plane with the throat, or mouth piece, constructed and operating as described."

---

33. For a *Corn Planting Plough;* Samuel Hoffner, Londonderry, Dauphin county, Pennsylvania, July 17.

There is not any thing special in this corn planting machine, although it differs sufficiently in the arrangement of its parts to entitle it to a patent. The claim is to the "constructing the hopper in two parts, by means of a vertical division passing through the middle of it, in combination with the moving bottom, or slide board worked by a crank attached to the roller; which sliding bottom conveys the corn and gypsum from each division of the hopper, and permits it to fall into the same furrow together. Also, the combination of the fenders for directing the seed into the furrows, as described."

It may be seen from the foregoing, that the division of the hopper is for the purpose of placing the seed corn on one side, and plaster of Paris on the other. The means of regulating the quantity of each to be deposited, do not differ materially from such as have been adopted in other machines for a like purpose.

---

34. For an improvement in *Lamps for Burning Spirits;* John S. Tough, city of Baltimore, July 17.

"This improvement consists in raising the horizontal plate at the mouth

of the shade for increasing or diminishing the draft, by means of a metallic frame or screw, instead of raising or lowering the shade or wick," and the claim is to this, and to the particular manner in which it is effected.

35. For improvements in the mode of making *Hammers and Hatchets*; Phineas Eastman, Concord, Grafton county, New Hampshire, July 17.

The eye of the hammer, or hatchet, is to be oval at one end, and round at the other, the round side being that at which the handle is to enter. This hole, or eye, is to be tapped in the round part, to receive an iron socket, which is to be screwed into it, and to pass through sufficiently far to occupy a portion of the oval part of the eye; an oval punch is then to be driven in at this end so as to open the socket to the eye, and prevent its turning. After this, a wooden handle is to be passed through the socket, and wedged in the ordinary way, to open it to the oval of the end of the eye. The claim is to the "making the socket with a screw on the outside thereof, to screw into the aperture or female screw for the same, and extending it into the oval part of the aperture in the hammer, a short distance, where it is made to assume a corresponding oval shape, by punching, or otherwise, to prevent turning or drawing."

36. For a *Razor Strap*; Aaron and Luther Hill, Stoneham, Middlesex county, Massachusetts, July 17.

"The object of our invention is to combine a draw for razors with the strap, making one handle answer for both draw and strap, so as to render the shaving apparatus as compact as possible."

"We claim the combination of the razor, draw, spring, and catch thereon, with the strap, as described, so that the handle and draw shall likewise serve as a handle to the strap, and by this arrangement supersede the necessity of a handle extending through the whole length of the strap." We presume that the foregoing contains all the information on this point that will be required to satisfy most of our readers.

37. For *Weigh Locks for Canal Boats*; Jeremiah Brainard, Rome, Oneida county, New York, July 17.

This weigh lock does not differ materially from those previously in use, and the claim is confined to "the manner of constructing the cradle so as to adapt itself to the pressure of its load by the passing of a chair around pulleys on its sides, constructed and operating as described."

38. For *Supplying Steam to aid Combustion in Steam Engine Furnaces*; John B. Pettival, Civil Engineer, Charleston, South Carolina, July 17.

"Under the fire, or grate, bars of the furnace to which my improvement is to be applied, I affix or suspend the apparatus which I have devised for the purpose of giving a supply of steam to the fire, this apparatus being applied without its being necessary to make any alteration in the ordinary fire-bars, or in any other part of the furnace. In its form, my apparatus bears a resemblance to the grate of the furnace, being composed of bars which may be so arranged, as, when in place, to be situated immediately under those of the furnace, and thus present no obstruction to the falling of the ashes from the fire. These bars are hollow, having each a perfora-

tion, or channel, for the passage of steam, from end to end; from these channels there are numerous small lateral passages for the escape of steam under the fire bars of the furnace. These perforated bars are connected at each end by cross bars, and their perforations open at each end into a channel, or tube, formed in these cross bars, for the purpose of establishing a free passage of steam through the system."

The claim is to "the making and using of a grate-formed apparatus, consisting of hollow bars, furnished with lateral openings for the emission of steam, said apparatus to be placed below the ordinary fire bars in the ash pit of a furnace, for the purpose described, and its general construction and adaptation being such as is herein set forth."

There is also a claim to "the particular manner of constructing said apparatus, by casting it in two separate portions, which, when placed one upon the other, and properly confined together, will leave the necessary channels for the conveyance and emission of steam."

---

39. For a *Grain Rake*; Israel Keyes, Putney, Windham county, Vermont, July 17.

"The object attempted in my invention is to gather the grain easily and quickly into quantities requisite for bundles, and to hold it, when thus gathered, at a convenient height from the ground until it can be bound, thus relieving the labour, by diminishing the necessity for stooping. To effect these purposes, the grain is gathered by six or seven fingers, somewhat resembling the fingers of a cradle, running beneath the grain, and these fingers are propelled by their buts, or rear ends, being fixed in an axletree, supported on two wheels, pushed along and guided by means of two handles." The claims are to "the method of binding grain by means of a rake, in combination with the uprights, or guards, as described. And also, in combination with the above, the stirrup for holding the grain up with the foot, whilst the bundle is bound."

---

40. For *Boxes, for Axles and Gudgeons to run in*; Isaac Babbitt, city of Boston, July 17.

There is now an application before the office for additional improvements on this patent, and when this has been decided, and completed, the specifications will be published.

---

41. For a *Progressive Pile Driving Machine*; Elijah P. Williams, Utica, Oneida county, New York, July 22.

"The purpose of my invention is to enable me to give to the pile driving machine a progressive motion, by causing it to be sustained by the piles themselves, without the aid of string pieces, or of cross ties, but simply by the aid of shifting wheels revolving on suitable axles, and so constructed that they may be shifted from the head of one pile to that of another, as the work advances, the pile driving machine having on its under side suitable ways or rails fixed along it, at such distance apart as that they may bear upon the above named wheels, and that the machine may be advanced thereon as the work proceeds, a grading saw, or saws, of any suitable kind, is to be employed to cut off the piles as the work proceeds, and thus to prepare them for the reception of the shifting wheels."

"What I claim is the employment of the shifting wheels, made and operating substantially in the manner described, for the purpose of sustaining

and advancing a pile driving machine without the use of cross, or other, ties, the piles being successively driven and cut off to the proper grades, for the purpose of grading."

The shifting wheels run between suitable cheeks, on cast-iron plates, which plates have projecting spikes on their under sides, or passing through them, to affix them in place.

---

42. For an *Antifriction Apparatus*; John G. Tibbets, city of New York, July 22.

This is said to be "a new and useful mode of applying rollers around axles, and balls at the ends and shoulders thereof, for reducing friction." The patentee says that he does not claim "the employment of rollers and balls to avoid friction in machinery, but what I do claim is the combination of the two sets of concave flanches with the balls working between them, to prevent the balls from rubbing against the axle and box, in the manner, and for the purpose set forth; and also the reducing the diameter of the rollers at the middle, to form a space for oil."

When we hear, satisfactorily, of the benefits derived from this apparatus, we will give to our readers the matter entire, with all its illustrations; we are very apprehensive, however, that the day is far distant when we shall be called upon to redeem this promise.

---

43. For an improved *Bee Hive*; Samuel C. Myers, Mount Pleasant, Westmoreland county, Pennsylvania, July 22.

After a description of considerable length, setting forth, by references to the drawings, the manner of constructing this hive, claims are made to "the arrangement of the drawers, ceilings, and slides, in combination with the rooms, glazed doors, and trunk, as described; and to the additional house for covering the bee house, for keeping the bees warm in winter, and cool in summer; also to the vertical slides at the ends of the bee house, and the trunks leading from one room to the other, all in combination, as described."

Such structures are capable of being made in so many different forms, whilst there is not, really, any substantial improvement effected, that there is often much difficulty in examining them when desired to be patented; and they must, in many cases, be rejected, or passed with a claim to "all in combination, as before described," which gets rid of the difficulty, as respects the examiner, but leaves the patentee without any other reliance than in making his apparatus always alike in all its parts.

---

44. For *Obtaining the Rectangle of any Irregular Figure*; Thomas Wood, Smithfield, Jefferson county, Ohio, July 22.

The claim under this patent is to "the application of the principle, that 'solids introduced into fluids, displace a quantity equal to their bulk,' to the mensuration of superficies by means of mercury and glass plates, as described." And the patentee says, "the nature of my invention consists in cutting paper to a corresponding form and dimensions with an accurate plot of the superficies to be measured, and introducing it into a stratum of mercury between glass plates."

The mode pointed out of obtaining the rectangle of an irregular figure, is about as useful and as accurate as some *mechanical* modes which have been proposed for obtaining the quadrature of the circle. It goes upon the

principle, that by ascertaining the quantity of mercury displaced by a rectangular piece of paper, similar to that from which the form of the plot is cut, the quantity displaced by the latter will give the elements of its rectangle, however irregular its outline may be. Who will buy a right?

---

45. For *Revolving Caps for Chimneys*; Bernard Kenny, Northfield, Franklin county, Massachusetts, July 22.

"The nature of my invention consists in combining with a revolving cap, a number of apertures surrounding the tunnel, through which openings air is to enter from without by the action of the wind, to assist the draught in carrying off the smoke, said apertures being constructed and operating in the manner of blinds, the slats of which overlap one above the other, leaving a space for the passage of air between them." The claim is to the cap so constructed.

---

46. For a machine for *Raking Hay, and Harrowing in Grain*; George Davis, Belmont county, Ohio, July 22.

The claims are to an "additional tooth inserted in the handle (so termed) of each rake, near to, and forward of, the head, forming a double toothed rake; and the combination of the rakes with the tilting frame, as described, by which each rake can rise separately, and the whole of them can be raised by means of the lever."

---

47. For a *Copp Speeder;* Truman Estes and Warren Dutcher, Bennington, Bennington county, Vermont, July 26.

We have here twelve pages of record, concluding with a claim to "the combination of the cap sheath and slide cup; also the combination of the transverse rod, spindle, and former, and these in combination with the cap sheath and sliding cup, by which the roving is twisted, wound spirally up and down under the former, and in the cup or cavity of the copp, and then condensed between the former and the sliding cup, as described."

---

48. For improvements in *"Nott's Coal Stove:"* Eliphalet Nott, Schenectady, New York, July 26.

The claims under this patent are, 1st, "connecting of the cover and ventilator in stoves in such manner that the two shall open and shut together, as set forth: 2d, the making use of *brick plates* for the walls of chambers of combustion in stoves and furnaces, whether angular or cylindric, constructed as above set forth: 3d, making use of a hollow *brick plate* prism for the lower front of the internal flue, as set forth."

The *brick plates* consist of metallic plates perforated with numerous holes, or covered with spiculae, so as to hold the fire clay, or composition, with which they are to be covered. And with these the stoves are to be lined.

---

49. For *Gas Burners:* George Darracott and Joseph Nason, Boston, Massachusetts, July 26.

"The object of our improvements is to render the passages in the burner, through which the gas is conveyed for consumption, more accessible, that the carbonaceous matter which is liable to collect in, and obstruct them, may be expeditiously removed."

The claim is to "the method of supplying the burner with gas through any number of straight perpendicular tubes, or apertures, opening into a

circular space above, and into a common feeder or reservoir below, which feeder may be taken off at pleasure for the removal of any obstruction which may occur in the said tubes or apertures."

The cylindrical body of the burner has a screw cut on its lower end, by which it is screwed into a bottom, or seat, which bottom screws on to the gas tube. Holes are drilled, in a vertical direction, between the openings in the cylindrical body of the burner, through which air is admitted to the interior flame; which holes lead into the annular space below the perforated steel plate for the jets. When this cylindrical body is unscrewed from its seat, any obstructing matter may be readily removed through the said straight holes. The circular space below the jet plate is cut from the solid metal, and the holes are drilled into it from below.

---

50. For *Constructing Rail Roads*; James Stimpson, Baltimore, Maryland, July 26.

"The nature of my invention consists, for the superstructure of railroads, in first placing heavy square or other shaped timber string pieces, or logs, hewed, or slabbed by saws, on two sides at least; that is, the sap should be removed from the top and bottom as laid in the earth, and these string pieces are to serve as the foundation of the road, and are to be laid in two continuous and parallel rows, about eighteen inches below the surface of the earth, for the support of cast iron chairs. The chairs are to be fastened on the top of the string pieces, and the longitudinal iron track rails are to be secured in the openings in the tops of the chairs. These chairs are formed with two upright standards resting on the middle, laterally, of each string piece, about the width of the track apart, and eighteen inches high, and connected by two trusses, ranging from one to the other."

Instructions are given for laying the string pieces where there are embankments, and also where there are excavations, or deep cuts. In all cases the wood upon which the chairs are fastened, is to be sunk deep in the ground, where it is estimated that the timbers will not decay in less than from fifty to a hundred years.

The claim is to "the combination of the wooden foundation string pieces immersed in the earth, with the iron chairs and track rails, in contact with zinc, or without zinc, as set forth."

---

51. For a *Brick Machine*; Daniel Carpenter, Courtland, West Chester county, New York, July 26.

We shall not attempt to describe this machine, which is intended for moulding and pressing bricks, it being too complex for verbal elucidation. The claims refer to the drawings, and it would be useless, therefore, to insert them here.

---

52. For a *Drill Barrow for Sowing Seeds*; Martin and Samuel L. Seward, Guilford, New Haven county, Connecticut, July 27.

There is not any general difference between this seed sowing machine and others of older date, and the claims made are to the particular manner of arranging the parts, as adopted by the patentees.

---

53. For a *Churn*; John S. Thomson, Wyalusing, Luzerne county, Pennsylvania, July 27.

This is a vertical churn, within which there is a vertical shaft, carrying

dashers. By means of suitable gearing, and a strap passing round the shaft above the body of the churn, said shaft is made to turn back and forth one half of a revolution. The dashers are composed of flat slats, set obliquely, like those of a window blind, and the claim is to the "placing the vertical paddles [slats] obliquely on the horizontal parallel arms, so that they shall force the cream, when moving in one direction, from the centre to the circumference of the churn, and when turned in the opposite direction, throw it back towards the centre, as described."

---

54. For an improvement in the *Grist Mill*; Henry Pearce, Cincinnati, Ohio, July 29.

This is said to be an improvement on the mill patented by J. C. Smith, on the 9th of January, 1830. The patentee says, "My improvement consists in the manner in which I construct the part which I denominate the pressure rod, which is intended to elevate the bridge tree, and consequently the running stone, and to regulate the action of the mill in this particular part." The pressure rod is constructed with a flanch around it, which, when the runner tends to rise, bears against a part of the frame within which the lower stone is inclosed, and counteracts this tendency.

---

55. For *Clearing Railroad Tracks from Ice, &c.*; John N. Dennison, and Elias Kirkpatrick, Plainfield, Essex county, New Jersey, July 29.

The plan for clearing off ice and snow from rails, consists in affixing scrapers and revolving brushes on the fore end of a locomotive. The scrapers are to be placed obliquely, so as to throw the ice, or snow, outwards, and they are fixed in spring bearings, so as to admit of their yielding when necessary. The brushes are made to revolve just back of the scrapers, and are intended to remove the snow, or ice, left by the scrapers. The claim is to this arrangement, which, we apprehend, will, in most cases, be so inefficient as to cause it soon to go out of, if it ever has been in, use.

---

56. For an improvement in *Locks and Latches*; Nathan and Caleb Hunt, Cleveland, Cayahoga county, Ohio, July 29.

This patent is taken for an improvement in the method of applying the lever and spiral spring to locks and latches for doors.

There is in this lock a slide, or lock bolt, and a latch which lifts by turning a knob, and these are combined together in a manner which prevents the latch from being lifted, when the door is locked. We do not think it worth while to give a long description of this contrivance, or of some other things connected therewith, as there is not any special merit in the affair, to render this lock better than others now in use.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent granted to HOMER HOLLAND, *of Westfield, Massachusetts, for manufacturing White Lead, &c. Dated March* 18, 1836.

To all to whom these presents shall come, be it known that I, Homer Holland, of the town of Westfield, county of Hampden, and state of Massachusetts, have invented a new and useful improvement in the process for oxidizing metallic lead, and for making and producing carbonate of lead, or

pigment commonly known by the name of white lead, which improvement has not heretofore been known or used, and that the following is a full and exact description of said improvement, sufficient to distinguish the same from all things before known, and to enable any person skilled in the art or science of making or producing the salts, acetate and nitrate of lead, from any oxide, or the carbonate of lead, to apply and use said improvement in the making and compounding of the same.

The invention consists, 1st, In an improvement in the method of applying the conjoint action of friction, air, and water to metallic lead, by placing fragments of this metal in revolving leaden cylinders, or chambers, so as to produce a fine powder, or pulpy suboxide of lead, for making, or producing, the commercial salts, nitrate and acetate of lead.

2d, In combining carbonic acid, from the atmosphere, directly with this suboxide, as it is formed in the cylinder, by the addition of carbonate of soda, or other alkaline carbonate, so as to produce or make the carbonate of lead, or the pigment known as white lead. To effect the oxidation of the lead, I put coarse shot, or other fragments of unalloyed lead, into a leaden cylinder, or chamber, about four feet in length and three feet in diameter, made to revolve, horizontally, upon an axis of flanches. The leaden cylinder, or chamber, is inclosed in a strong and tight wooden case; air is admitted by perforations of the cylinder at its ends, near the axis; soft water is put into the chamber, sufficient to cover the charge of shot, or fragments. The cylinder is made to revolve eighteen or twenty times in a minute, by the application of any force, and the electro-chemical action of the friction, air, and water, produces a fine pulpy suboxide of lead, which is strained out by removing a bung from the side of the cylinder, and placing therein a hollow tube, leading to a sieve, or strainer, resting on a canal, or trough, which conducts to a reservoir.

This pulpy suboxide, sufficiently freed from water, is readily combined with acetic acid, giving "sugar of lead," and with nitric acid producing nitrate of lead. To make carbonate of lead, the process is identical with the above described for the suboxide, with the addition of about six or eight ounces of the carbonate of soda to each gallon of water used in the cylinder. The cylinder is revolved several hours in producing the suboxide for the salts of lead, and from twelve to sixteen previous to straining out the carbonate, or white lead, which is conducted, as above described, to a vessel armed with agitators, and washed, by decantation with pure water, once or twice, to free it from alkali, when it is to be dried by any convenient means, becoming the pure carbonate, or "cream" white lead of commerce. In this process for white lead, the use of vinegar, and of acetic, or acetous, acid, in any shape, is avoided, and the health of the manufacturers is preserved from the fumes of the volatile peracetate of lead, so deadly in the ordinary process. The foregoing process I prefer; but the revolving chambers may be cylindrical, square, or polygonal, of any size and length. The lead linings of a wooden cylinder may be of sheet lead, or cast in a cylinder to fit the wooden case, or carcass, and are to be renewed from time to time as they frit away. The number of cylinders, their weight, and the charge, will depend on the force employed, and the extent of the manufacture. Each cylinder, (principally the lead chambers) may weigh 600 lbs.

The charge added is from 100 to 150 lbs. in fragments, and the necessary water and carbonate of soda. The lead fragments may be shreds of sheet lead, shot, or fragments produced by pouring melted lead through a colander into water. Antimony, and other alloys of metals, are often mingled

with lead in the shot of commerce, and unfit them for this process. The alkali preferred is soda, as this has the strongest affinity, or attraction, for oxygen and carbonic acid, and is less liable to form a hydrate. The pulpy suboxide may also be conveniently carbonated in the vessel employed for decantation, (as it is armed with agitators) by passing it into the pulpy suboxide, as withdrawn from the cylinders. Carbonic acid, produced by the combustion of charcoal, by fermentation, or by the decomposition of carbonate of lime, or chalk, by sulphuric or hydrochloric acid. The decanting vessel, again, may be used conveniently in removing the disagreeable yellowness of pure carbonated lead, by minutely mingling a trifle of indigo, or blue smalts, with the carbonate of lead.

I claim, as my invention and improvement—

1st. The application of the revolving cylinders, or chambers, as above described, to the fritting, comminution, amalgamation, or converting of metallic lead into the fine pulpy suboxide of lead, for the salts, acetate and nitrate of lead—or carbonate of lead.

2d. The carbonating of the above described suboxide, as it is formed in the cylinder, by the addition of an alkaline carbonate, or by passing into this pulp directly, carbonic acid, giving immediately white lead.

HOMER HOLLAND.

Specification of a patent for Manufacturing Carbonate and other Salts of Lead. Granted to HOMER HOLLAND, *Westfield, Massachusetts, November 3d*, 1838.

To all to whom these presents shall come: Be it known, that I, Homer Holland, of the town of Westfield, in the county of Hampden, and state of Massachusetts, have invented several new improvements in processes for compounding, making, and producing pulpy compounds from metallic lead, and of converting said pulpy lead into sulphate and carbonate of lead for white pigments; and also for making of said pulpy lead into chromate of lead, known as chromic yellow; which special improvements in compounding have not heretofore been known or used: and that the following is a full, discriminating, and exact description of said methods, sufficient in detail to distinguish the same from all other processes, and to enable any one skilled in chemistry to apply and use said improvements understandingly. The special improvements which I would describe and claim, consist, 1st. In using any alkaline salt, or substitute, in the moistening solution for the charge and chamber, or open headed cylinders, described and mentioned in my patent dated the 18th day of March, 1836, whose elements consist essentially of oxygen, carbon, and hydrogen, in any proportions, instead of alkaline carbonates, before recommended and employed, as they augment the electro-chemical action, increase the product, and modify and facilitate the combination of the elements with nascent pulpy lead, by their presence, or catalytically.

Acetates of lead, whether neutral or basic, also sugar, and even alcohol, may be advantageously used in the solution, to moisten charge, chamber, and pulp.

2d. In adjusting the pulpy plumbic compound, produced as described in my said patent, for acetate and nitrate of lead, or with the catalytic additions with neutral chromate of potash, or soda, or by dissolving the alkaline

chromates in water, and using this chromic solution as the moistening of charge and chamber.

The chromic pulp, after subsiding, may have most of all the alkali withdrawn by decantation, and the remainder neutralized by washing with water, made acid by sulphuric or other acid.

The commercial bichromates of potash and soda are to be made neutral by the addition of suitable proportions of their respective bases.

The economy of the above process, in making chromates of lead, is in substituting the plumbic compounds in their nascent state for the expensive plumbic salts, acetate and nitrate, now usually employed in the manufacture of chromic yellow.

3d. In my said patent for oxidizing and producing lead pulp, although, in the incipient stage of the operation, the lead may be an under oxide, the subsequent exposure, in the open-headed chambers, to the continuous and conjoint action of the elements which constitute the atmosphere, water, and catalytic additions, together with the friction, and the known and established property, or capacity, which all metals, in a minute state of division, have of absorbing, "dissolving," or combining with, all elements with which they are in contact, constrains me to disclaim the opinion, that plumbic pulp, under any circumstances, can be considered a definite compound, and much less an oxide; but that it is a compound of lead, into which the elements, hydrogen, carbon, and nitrogen, and their compounds, enter, as well as oxygen.

By the foregoing explication of the pulpy plumbic compound, the following rationale of the modifications of the pulp, in converting it into a perfect carbonate, or sulphate, will be apparent. After carbonating the pulp with certain catalytic additions, artificially, should there be any basic salt, it is to be removed by washing in an alkaline solution, boiling, particularly in making the sulphate of lead, the pulp must be boiled to modify the plumbic hydrate by more highly oxydizing the pulp.

The sulphate of lead is made directly from the pulpy lead, modified and oxydized by heat, while in its moistened state, by digesting it, in any quantity, with sulphuric acid of commerce, previously diluted with twice its measure of water, (more or less) and suffering the acid thus diluted to become perfectly cold previous to adding the pulpy lead.

It is necessary to boil the dilute sulphuric acid and pulp thoroughly together in a shallow leaden vessel, with rather an excess of acid, that the product may become a perfect sulphate; in this, great caution is requisite, otherwise the product will be, more or less, a mixture of sulphate, hyposulphate, or sulphanide, of lead, and its colour changed by mixing and painting in oil. Besides, it will not be as dense, fine, and fusible.

All the pigments should be thoroughly washed in several waters, and may be dried by the well known methods.

The cylinders mentioned in said patent, I now make about four feet in length, and thirty inches in diameter, wholly of lead, either sheet or cast, about one-fifth of an inch in thickness. The ends are entirely open, except an inner rim to retain charge and moistening fluids, or solution, with forming pulp, and allow a free circulation of the atmosphere for its elements.

They are mounted on an axis, passing through their centres, and the centres are of iron, with arms which are attached to the rims of each end of the cylinders. The rotations may vary from six to nine times in a minute, and are moved by a drum and belt, or other gearing. The pulpy lead may be withdrawn every six, eight, or twelve hours. The medium charge is

fifty pounds, and the moistening fluid, or solution, from three pints to three quarts, or more.

I claim, 1st. The process and method of using the alkaline salts, carbonates, and other catalytic substitutes, as hereinbefore mentioned, in moistening charge, and chambers, described and mentioned in said patent, in producing pulpy plumbic compounds; and I do not intend to restrict their application and use to pulpy leads produced by revolving chambers alone, but to extend their application to the compounds of lead produced by other methods of friction, whether substituted, or adopted, to evade my chambers.

2d. I claim making chromate of lead, as above specified and described.

3d. I claim modifying the pulpy plumbic compounds above described for carbonate of lead, and particularly the processes described for making a definite sulphate of lead, by digesting, boiling, and washing, as above discriminated, and made plain and distinct. HOMER HOLLAND.

Specification of a patent for an Improvement in Manufacturing White Lead. Granted to SMITH GARDNER, *city of New York, August* 28, 1840.

To all whom it may concern: Be it known, that I, Smith Gardner, of the city of New York, in the state of New York, have invented an improvement in the process of manufacturing white lead, known to the chemist under the name of carbonate of lead; and I do hereby declare that the following is a full and exact description thereof.

The first part of my procedure consists in the treating of metallic lead by the well known process by which a pulpy substance is produced, which is known to manufacturers under the name of suboxide of lead. This process consists in the placing of granulated lead, or lead in fragments, in vessels lined with sheet lead, and containing water. These vessels may be in a cylindrical form, and made to revolve on their axes, like barrel churns, or they may have a reciprocating instead of a revolving motion; and they may be, and have been, varied in form in different ways, the only essential point in their construction being that the lead contained within them may be subjected to continued attrition. Thus far, the process is identical with that which has been adopted and followed in many manufactories, in which it has been attempted to manufacture white lead from the suboxide of lead so produced.

In these attempts it has been proposed to carbonate the suboxide of lead, by putting portions of carbonate of potash, carbonate of soda, or other carbonates, into the water with the lead undergoing attrition, it having been supposed that the alkaline carbonate would give up its carbonic acid to the oxide of lead, as said oxide was formed. Independently of the known affinities of the respective articles named, I have proved, by repeated experiments, on a large scale, that carbonate of lead cannot be produced in that way. Another attempt to convert the suboxide of lead, obtained by trituration, into white lead, has been by taking the said pulpy oxide, agitating it in a vessel containing water, and forcing a stream of carbonic acid, or of carbonic acid mixed with atmospheric air, through it. By this process a carbonate of lead has been produced, but in so imperfect a manner, as to leave it destitute of all the essential properties of that article; wanting the density, body, and freedom from colour, found in good white lead. In consequence of these defects, the attempts hitherto made to manufacture white lead from the suboxide produced by triturating fragments of lead in leaden vessels, under water, have proved abortive; but, by a very simple variation of the

process, I have succeeded in producing good white lead, which has been pronounced by judges to be equal to the best that is imported.

As it was fairly proved that the suboxide would not combine with the carbonic acid, after said suboxide had been fully formed, I determined to vary the process so as to present the carbonic acid, in conjunction with a portion of atmospheric air, to the suboxide of lead in its nascent state; and this I have found perfectly effectual. In order to effect it, I triturate my lead with water in leaden cylinders, or other vessels, as above described, but, instead of leaving the vessels open, or perforating them, for the admission of atmospheric air, I make them close, by means of suitable shutters, or stoppers, which may be removed whenever it is necessary so to do; and during the whole time that the trituration is continued, I introduce carbonic acid, accompanied by atmospheric air, into the triturating vessels. When these vessels are in the form of horizontal cylinders, I pass the gases into them through hollow gudgeons; a mode of construction and procedure well known to machinists; under other forms or modes of constructing my triturating vessels, I adopt whatever means I may consider the best for introducing the gases within them. The result of this process is, that the nascent suboxide of lead presented to the oxygen of the atmospheric air, and to the carbonic acid, combines with them, and at once produces a perfect carbonate of lead, possessing all the essential properties of that article. I in general open each triturating vessel once in about twelve hours, to remove the carbonate of lead which has been formed within it. This may be done more or less frequently, according to circumstances.

When the carbonate of lead thus manufactured, is first obtained, it generally has a light tinge of blue, but this disappears in the process of drying, and it is not important, therefore, to adopt means to prevent it; I have found, however, that by introducing a very small portion of the vapour of vinegar in conjunction with the atmospheric air and carbonic acid, the white lead is at once obtained perfectly free from colour.

The carbonic acid may be generated by the combustion of coal, or by the decomposition of carbonate of lime, or of other carbonates.

Having thus fully shown the manner in which I conduct the process of manufacturing white lead, or carbonate of lead, and pointed out the difference in the process as adopted by me from those heretofore followed, what I claim therein as of my invention, and desire to secure by letters patent, is, simply, the introduction of carbonic acid and of atmospheric air into closed *vessels* in which fragments of granulated lead is subjected to long continued attrition in water; the introduction of these gases being intended to supply the portion of oxygen and of carbonic acid necessary to convert the nascent suboxide of lead into white lead; by which means a perfect combination is effected, and the desired result attained, as herein set forth.

SMITH GARDNER.

Remarks by the Editor.—We have inserted the three foregoing specifications on the manufacturing of white lead, and of other compounds of lead, because the particular process upon which they are dependent, that of producing these compounds from lead comminuted by trituration, has, of late, excited much interest, and been a subject of frequent inquiry. The first of these specifications leads to the conclusion, that Mr. Holland supposed this process to be new in the year 1836, whilst the fact is that it was the subject of a patent obtained by Joseph Richards, of Philadelphia, in the year 1818. A manufactory was also established at Norristown, Pennsylvania,

in which the triturating process was employed, and after essaying the thing for a considerable length of time, the plan was given up. The white lead produced was deficient in body, and its colour was said not to be good.

That Mr. Holland found the process of 1836 defective, is to be inferred from his patent of 1838, for improvements in it. We should be glad, however, to obtain his own account of this matter, as we might err greatly by detailing the information received from others.

Mr. Holland's second specification we think much more elaborate than clear; had language more simple been used, it would have rendered his meaning more obvious to the great body, even of those "skilled in the art." We have ventured to insert, and to change a few words, where we thought that it might be safely done, but further than this we have not gone.

On the 7th of June, 1838, Mr. William Cumberland, of New York, obtained a patent for a process of manufacturing a white pigment, the specification of which we published in vol. xxiii., p. 402. The patent obtained by Mr. Gardner is, it will be seen, for a particular variation of the process of oxidizing and carbonating the pulpy lead, and by which, he states, a very superior white lead is obtained; and his statement has been corroborated by others. We shall have something further to say on this subject.

Progress of Practical and Theoretical Mechanics and Chemistry.

M. D. Richemont's Autogenous Soldering, or new mode of joining plates or tubes of lead and other metals without soldering.

"Autogenous soldering" is the term given by its inventor to a new method of joining one piece of metal to another without the use of any solder. The autogenous *junction* of metals is a phrase by which the invention might, perhaps, with more propriety be designated. But be this as it may, the invention is one of vast importance both to our chemical and engineering manufactories, and will speedily work out a name for itself, and for its inventor a distinguished reputation. The process consists in uniting the parts to be joined, by fusion of the metal at the points or lines of junction; so that the pieces, when joined, form one homogeneous mass, no part of which can be distinguished from the rest even by chemical analysis. And this result is obtained by means of intense jets of flame, produced by the combustion of air and hydrogen gas, and are rendered quite as manageable as more substantial tools.

The inventor, Mons. E. Desbassays de Richemont, obtained at the last National Exhibition of Arts at Paris, a gold medal for his invention. The committee on whose recommendation the medal was awarded, included those distinguished chemists, Gay Lussac, Thenard, D'Arcet and Clement Desormes; and their report concluded in the terms:—"We consider M. Richemont's invention of the highest importance; it is applicable to many branches of industry, and will render signal service to a great number of manufactures. Its efficiency too has not only been established by experiment, but is evidenced by the fact of most of our eminent manufacturers and tradesmen having taken out licenses for the use of it."

Patents have been also obtained for the process in Great Britain and Ireland,* of which Mr. Charles Delbrück is the proprietor.

* The English patent was taken out in the name of Mr. Hebert, for "Autogenous Soldering of Lead."

The invention has been put in operation by Mr. Delbrück, on the premises of Messrs. Andrew Clarke and Sons, Plumbers, in Southwark, where we have had the pleasure of witnessing the complete efficiency of the process, as applied to the manufacture of vessels, tanks and other articles of lead, and also sufficient to convince us of its applicability to the soldering of the harder metals.

[The apparatus consists of a hydrogen gas blowpipe attached to a vessel in which the gas is constantly generated while the soldering is in operation. A square leaden tank or vessel is divided horizontally into three compartments. The upper one contains dilute sulphuric acid, and the lower one zinc cuttings, and by a tube which passes from the one to the other, governed by a plug, the acid is let down upon the zinc at pleasure. The gas passes into a vessel containing water, placed in the middle compartment, and thence through a tube to the blowpipe. This tube has a branch connected with a double bellows which may be worked by the foot of the operator. Thus a stream of ignited hydrogen, fed at will by one of atmospheric air, is made to play with great ease upon the surface to be soldered. A figure of the apparatus is given in the London Mechanics' Magazine, No. 872.]

From the description given of the new mode of joining metals, it will be seen that the junction is necessarily secure from the chances of flaw which in the old method were occasioned by—1, the difference of expansion between the lead and its alloys with tin, a difference which is particularly felt in very low or very elevated temperatures; 2, the electro-chemical actions which are developed under certain circumstances by the contact of two heterogeneous metallic substances;* 3, the very powerful reaction which a number of chemical agents exercise upon alloys of lead and tin though not upon lead alone; 4, the extreme fragility of these alloys, which, particularly when heated, break sometimes on the slightest blow; 5, the difficulty of making the solder take and adhere to the surface of the lead where it sometimes only sticks without the workman knowing it; and, 6, the use of rosin which so frequently conceals fractures for a time.

As the method of M. de Richemont is, however, employed by persons upon whose care it is impossible always to depend, it cannot be pretended that the autogenous soldering never presents any defects; but then they result *only* from negligence, the nature of the work being such that however little attention the workmen may give to it, they ought immediately to perceive the smallest imperfections: good workmen may therefore always guarantee beforehand the goodness of their work, which the uncertainty of the old method would rarely allow.

We may therefore justly state, without being taxed with exaggeration, that the adoption of the new method of soldering will very much diminish the number of cases of the escape of water and gas, which occasion every day so much inconvenience, and even danger, as regards the stability of buildings, the maintenance of the public thoroughfares, and the security of life.

The disuse of charcoal and tin, by plumbers, will be an important means of rendering their trade less unhealthy—the exhalation of their brasiers and

* M. M. Vauquelin and D'Arcet have seen in soap works the soldering of vats lined with lead, crumble in a few days to a state of powder. The same has been remarked of leaden pipes passing through certain soils.

the arsenical vapours emanating from impure tin, being frequently the cause of serious maladies.

Finally, we may be permitted to add, that if the new method of soldering had been in use, we should not have had to deplore the destruction by fire of the corn-market of Paris, of the cathedral of Chartres, or that of Bruges, which was occasioned by the negligence of plumbers; negligence for which if the present invention were used there could be no reason, since it is only requisite to turn a cock in order to extinguish or relight, at any moment, the jet of gas which serves for the plumber's tool.

To these various considerations drawn from the public interest, and which alone ought to secure a preference to autogenous soldering on the part of the Government, the public, and men of science; we will add a few others, which though of a minor importance, are not unworthy of notice.

Such for instance are the advantages presented by this method in an economical point of view.

The total disuse of the alloy of lead and tin now employed will enable the master plumbers to reduce the prices of their work very considerably in many cases, and will prevent as well in regard to themselves as to individuals who find their own materials, those abuses so publicly notorious, which the use of so expensive a material gives rise to, and which at the same time, so easily escape detection.

The disuse of seams or overlappings, which from this new mode of connecting lengths of lead, will almost entirely be given up, will alone occasion a considerable saving in the quantity of lead employed.

The extreme facility with which lead of from one-thirtieth to one-tenth of an inch in thickness may be soldered and defects repaired, will permit of the substitution of this, in many cases, for thicker lead, and thus diminish the expense; perhaps also it will give rise to the use of lead for purposes to which it has not yet been applied, or the return to others, in which, from motives of economy, it has been supplanted by other metals.

In a purely technical point of view, the art of the plumber will be indebted to M. de Richemont's method for several improvements of high importance. Thus he will be enabled henceforward to make joints internally wherever a jet of flame can be introduced and directed; to reconstruct on the spot, of pure lead, any portion of a vase, a pipe, or a statue, that may have been removed or destroyed; to execute one after another any number of successive solderings; to repair in a few minutes without even leaving a trace, dents, cracks, flaws, &c., in sheets or pipes of new lead, or the defects of the autogenous solderings themselves; to do away entirely if desired, with the enormous edges or knots left by the old-fashioned joints, and that without weakening them; in short, to give to works of lead a precision of execution, and a solidity, unattainable up to this time, so that this metal shall be available at once in all the combinations required by the civil and hydraulic engineer, however complicated they may be, and in all the ornamental forms that the architect may desire to give it.

But there is a class of artisans to whom the processes of autogenous soldering are more important than to all the rest, namely, those who follow the various and numerous branches of the chemical arts. The possibility of making of pure lead, vessels and instruments of every form and all dimensions, is for them, we may boldly assert, an important attainment; for in chemistry particularly, the execution of the happiest conceptions has been frequently arrested by the imperfection of the means. We therefore think

it necessary to enter into some particular details on the application of autogenous soldering to the necessities of these arts.

We will not dwell on the difficulties experienced, even in experimental laboratories, in procuring retorts, recipients, jars, basins, &c. of pure lead, which can only be accomplished with difficulty and by a long and expensive process; but to give an idea of the importance that practical chemists attach to the having at their disposal large vessels of lead without alloy, we will remind our readers that the *Société d'Encouragement*, who so justly appreciate the progress of national industry, awarded, in the year 1835, a gold medal to Mons. Voison for having succeeded in casting a sheet of lead sufficiently large to make, by raising and turning in the angles, boilers of one piece and without soldering, applicable to the various purposes of the chemical arts.

In future there will be no limit to the size of sheets of lead in a single piece, whether cast or in layers, since it now only depends upon the number of sheets that it is desired to unite in one. Thus the boilers necessary for the process of acidification and the concentration of saline solutions may be constructed of pure lead whatever be their dimensions. The same applies to scouring vats (*bacs à dérocher*,) employed by so many artisans who work metals, to crystalizing tubs, and, in general, to vessels of every kind used to contain liquids which act upon the tin solder.

Independent of the advantages which the autogenous soldering offers in the construction of new utensils, in regard to dimensions and form, the facility that it gives for repairing them is, perhaps, in an economical point of view, still more important, particularly for such as are exposed to the action of heat. By the old method, the holes which are so frequently caused in the bottoms of these vessels, either by the action of sudden flames, or by deposits that form on their surface, can be stopped only when they are not of too large dimensions, by making what are called weldings of pure lead. The cases in which this mode of repair is possible are very limited, and whenever it is impracticable, the boilers must be taken down, the lead changed, and then reset; operations, the expense of which, at all times considerable, is augmented by the distance from the place whence the metal is procured, from the cost of transport, and the longer interruption to business. Now nothing is easier than to apply pieces, whether at the bottom or the sides of the vessels, whatever be the size of the holes; and by this means one may actually renew, piece-meal, the whole of a boiler. There will therefore never arise a necessity for changing them, except when entirely worn throughout, and then there will be this advantage, that the old pieces, instead of being a mixture of lead and solder, will be free from every kind of alloy, and consequently, will yield at the melting pot a metal perfectly pure.

The very great ductility of lead, which in many cases is one of its most valuable qualities, is, on the other hand, a great inconvenience whenever we require utensils or instruments capable of offering a certain resistance. At the same time, there are circumstances where this metal alone can be employed, on account of the manner in which it resists chemical action. By constructing vessels or instruments of iron, zinc, or wood, and lining them, either externally or internally, or on both sides at once, with thin lead, which can always be done, however complicated their forms, we shall in future have utensils that will resist pressure and blows, and likewise all the chemical agents, as well as if they were entirely made of pure lead. Without entering into a detail of the operations to which this plan may be most suc-

cessfully applied, we will mention, by way of example, the production of hydrogen under a heavy pressure, the preparation of soda water and other gaseous waters, the distillation or evaporation of acid or alkaline fluids, under a lower pressure than that of the atmosphere, &c.

It is almost superfluous to add, that the various utensils, such as funnels, pumps, syphons, shovels, spatulas, spoons, ladles, measures, stoppers, skimmers, &c., employed in chemical factories, may always, by this means, be made of wood, or metal, covered with lead.

Another application that deserves some notice, is that of lining common barrels with lead one-sixteenth to one-eighteenth of an inch in thickness. These vessels would be of great utility in chemical factories, more particularly in the construction of the apparatus of Woulf and other pneumatic instruments,* to which greater dimensions could be given by this means; but they could be employed with singular advantage in the transport of acid and alkaline liquids by sea and land. We know, indeed, that all liquid chemical products, and especially the sulphuric and hydrochloric acids, are transported in stone bottles placed in baskets, which, when sent a great distance, must, on account of their fragility, be covered with a double package. This precaution is, however, far from being sufficient always to prevent those accidents which the breakage of these bottles would occasion, both in the loss of the acid, and its action on surrounding bodies. Thus the exportation by sea, of the sulphuric and hydrochloric acids, is limited to a small number of parcels, and is absolutely *nul* in regard to those countries that can be reached only by long voyages—the case of the two French ships that perished at sea on a voyage to the colonies, in consequence of the breaking of some bottles of sulphuric acid, having with good reason alarmed the owners and assurance companies.

By putting these acids into barrels lined as we have stated, and closed by means of plugs of lead soldered, we may effectually escape all accidents of this kind; and the conveyance of these acids will be attended with no more danger than that of any other liquid. These lined barrels offer, besides, a considerable advantage over the bottles in single or double cases, in regard to the tare and the bulk, an advantage which must naturally be the greater, from the barrels having a larger capacity, and the quantity conveyed being larger, the selling price will be lower. This will be particularly obvious in the case of hydrochloric acid, the price of which is so low that it will not admit of carriage to places at any distance.

Barrels lined with lead are particularly adapted to keeping acids and other chemical products in store, and we may presume they will, on this account, come into general use among persons who retail, or habitually consume, these articles; such as chemists, apothecaries, druggists, grocers, &c. By means of cocks conveniently disposed, and syphons or hand engines of pure lead, similar to those of publicans, these liquids can be drawn and served with the greatest facility, while these operations are always dangerous to persons not well accustomed to them, when stone bottles are employed.

* Nothing can be more convenient than the new method of soldering for filling up Woulf's apparatus, and all others in lead, from the facility that it gives for soldering, unsoldering, and resoldering, as many times as may be desired, the pipes, tubes, lids, &c. There is no practical chemist who will not be instantly struck with this advantage; and it is probable that hereafter soldering may supplant, in numberless cases, the lutes that are now employed, and which so frequently occasion miscalculations and loss of time and money.

Hitherto it has been impossible to introduce into chemical factories, the system of evaporation by means of pipes heated by steam, because of the action of the acid or alkaline fluids on the worms of copper or lead soldered with tin, which it was necessary to make use of. At the same time, the advantage of this system, which has been adopted for several years in different arts, would be still greater if it were applied to fluids that are evaporated in leaden boilers, such as solutions of alum, copperas, ammoniacal salts, &c.; for, as these boilers cannot be in immediate contact with the flame, but are always of necessity separated from it by an inch either of metal or of masonry, the fuel is far less economically employed in this mode of heating than in any other, and yet every body knows that in the preparation of the majority of the salts, the expense of fuel is one of the most important elements of the price of the product. The ease with which boilers, or other utensils heated by steam, may be arranged at any height, and in any position—with which any form may be given to them without reference to the situation of furnaces—with which the application may be suddenly suspended, checked, and renewed at will, and at any period of an operation, by simply turning a cock, will be invaluable in the chemical arts, under many circumstances already known, and a number of others that may be foreseen—the progress that science is daily making tending to show that the reactions vary exceedingly with different temperatures.

By the aid of the new method of soldering, all these advantages will be easily realized, since we can now make worms of pure lead in any shape, of any dimensions, and of any thickness; and if it were necessary to exceed the limits of ordinary pressure for fluids of great density, such as sulphuric acid for instance, we could no doubt employ a pipe of iron or copper lined with lead, the resistance of which would then be indefinite. With regard to the coppers themselves, there would be nothing to prevent the use of those of one-eighth of an inch, instead of from two-eighths to four-eighths of an inch, which it has been necessary to use hitherto; and yet we shall be secured from the effects of the fire, which, by causing holes, frequently occasion an enormous loss in material, to say nothing of the various expenses enumerated above.

We will conclude with a few observations on the very particular importance of M. de Richemont's method in sulphuric acid factories.

It is well known that the establishments in which this acid is manufactured are composed of a series of chambers or utensils of lead, which present, generally, a capacity of 25 to 50,000 cubic feet, and sometimes from 200 to 250,000. There is not one of these factories, the construction of which does not employ many thousand pounds weight of tin solder. The constant contact of the lead and the solder with the sulphuric acid, and particularly with the nitrous vapours, subjects the solder to an action so powerful, that in a short time there are so many fissures, produced by its destruction, as to render useless, if not the entire apparatus, at least some of the chambers which compose it. Thus the manufacturers are burthened every year with repairs and partial reconstructions, which are the more expensive because they bring with them all the cost of demolition, changing the lead, stopping of the works, and resetting the apparatus. No doubt the action of the nitric acid on the lead itself plays an important part in the destruction, more or less rapid, of the chambers; but on the other hand, we are correct in stating that they are injured particularly at the parts soldered, and more especially at the angles, where the acids are in direct contact with masses of solder. We are therefore justified in hoping that chambers constructed en-

tirely of pure lead would prove more durable than those soldered by the existing method.

A circumstance that adds to this probability is the facility with which we shall be enabled in future to repair the slightest damage at the moment it occurs, even while the chambers are at work, provided the part affected be in sight, and thus prevent the increase of holes, or cracks, which, when neglected, it frequently becomes impossible to repair without stopping the works, which always occasions a heavy expense. The constant examination and preservation of the lead work will be the more easy under the new system, since it permits the adoption of a mode of finishing and setting, by means of which almost the whole of the angular joints, and generally the vertical ones, are made on the outside of the chambers. The *Chalumeau aerhydrique* being besides always in readiness, and as its flames can be conducted without even deranging the instrument, to a distance of several fathoms from the place where it stands, people will no longer be disposed, as before, always to delay repairs apparently insignificant, for the sole reason that it was necessary to light a brazier, to heat irons, to melt masses of solder, and sometimes to disturb several workmen, to carry the whole into the centre of some complicated carpentry,—difficulties that are of great weight in practice.

What we have before stated respecting the advantages arising from the disuse of seams, will apply particularly to chambers for sulphuric acid, in which this mode of soldering is employed. But this advantage, although very great, is here but little in comparison with that resulting from saving the whole of the solder; and if we add that in most localities the use of gas offers a considerable reduction in the expense of fuel, and that there is also a great diminution in the work of the men, it will be seen that if the manufacturers of chemical products really know their own interests, there will not henceforward be a single sulphuric acid chamber constructed or repaired on the old system. In fact, the manufacturers of Paris were so sensible of this, that even before Monsieur de Richemont's method had attained any kind of publicity, they came to him to treat for its introduction into their establishments, and since that time the system has been adopted in the greater number of the sulphuric acid factories of the north of France. Among others, M. Gay Lussac (the Faraday of France) has taken a license for the establishment of St. Goblins, which is under his immediate superintendence.

Independently of its application to the autogenous soldering of lead, the flame of the aerhydrique blow-pipe may be applied directly in using for solder, either the common alloys or pure lead, to unite zinc and iron, and lead, with iron, copper, and zinc.

It may be substituted also, with the greatest advantage, for the common blow-pipe and the lamp of the enameller, in all their applications to the soldering and joining performed by the aid of these instruments, by jewellers, goldsmiths, tinmen, manufacturers of plated goods, of platina, of buttons, &c.

This will readily appear if we reflect that while hitherto the parts soldered must of necessity be carried to the flame, it is, on the contrary, the moveable flame that is here conducted at will by the hand, to all the points that are to be exposed to the action of heat, whatever may be their position. On the other hand, the jet of the aerhydrique blow-pipe being susceptible of infinitely greater power, may be applied to works of much larger dimensions, and on this ground it may be usefully employed in certain

cases, by braziers, copperplate workers, locksmiths, tinmen, &c. As the sphere of action of the heat necessary to effect the fusion of the metal, can always be limited at will, one need never be afraid, while welding or soldering one part, of melting the part adjoining, and hence a very great facility in finishing a multitude of delicate articles, and above all, in effecting repairs that were heretofore impossible.

The applicability of this mode of soldering to the tubes of locomotive engine boilers, is deserving of particular notice. Not only can the flame be conveyed to the parts required to be soldered with great convenience, but the flame is free from those sulphureous admixtures which are unavoidable when the metal to be soldered is brought into contact with the vapours of burning coal.

There is another peculiar application of the flame produced by the combustion of gas, that has been effected by M. de Richemont, which it is not irrelevant to mention here; it is that of heating, by this means, soldering irons, such as those used by tin plate workers, zinc workers, plumbers, tinmen, &c. A few seconds suffice to bring the iron thus heated to the desired temperature, and it can be kept at that temperature for whole days without being liable to burn, the workmen having nothing else to do but to regulate the flame by means of cocks, and not being obliged to change his iron, or even to leave it for a single moment. Hence a considerable saving in manual labour, to say nothing of that in fuel, which will vary with the comparative value of the gas that can be procured, and that of coals, but which, in Paris, for instance, will be always one-half of the present cost.*

Lond. Mech. Mag.

On the Production of Electrotypes. By Alfred Smee, *Esq., Surgeon.*

The mode of taking copies of medals by the galvanic current† is deservedly occupying much of the public attention, and each is striving to add his mite to the perfection of this elegant and useful process. There are two or three points to which I am desirous of drawing the attention of your readers, as they appear to open a new and important field for investigation for which I have not the time at present. With regard to the precipitation of the copper, I beg leave to submit a modification of a plan first proposed by Mr. Mason, in a paper read before the Electrical Society, but I believe also contemporaneously used by other persons, that of making copper form the oxygen side of the battery, which being dissolved, is again thrown down at the platina or hydrogen end upon the medal or mould placed for its reception.

The mode which I adopt is, first to obtain a long dish or trough, and then to place a wire in the inside along its bottom, which is connected to the zinc of one of the cells of my battery along the opposite side of the vessel; a large piece of copper is placed in connexion with the silver of the battery, and a solution of sulphate of copper is then added. By this ar-

*It is calculated that in London if the common gas which is employed for lighting the houses and streets, be used for heating soldering irons, the cost for each workman during a day's work of twelve hours, would not exceed three halfpence, and for each zinc worker two pence halfpenny.

† We learn from the foreign journals, that Professor Steinheil, of Munich, is applying this process for making a cast in copper, from a composition by the celebrated sculptor Schwanthauler, representing the labours of Hercules, and containing 140 figures.—Edit.

rangement the current is generated at the zinc, passes to the medal, reduces the copper whilst the oxygen and acid are transferred to the refuse copper, and dissolves a corresponding quantity of copper, and by this means the solution is always kept saturated with the metal.

When medals are to be copied, they are singly placed in contact with the wire in connexion with the zinc of the battery, and in this way many may be done in the same vessel, and any may be taken out and examined without the slightest interruption to the others. The rapidity of the process may be increased without detriment by the use of two to six, or even more, cells of the battery, as the copper will still be extremely tough. It will be found that my battery will require not the slightest alteration, except once a day, when the liquid should be changed. I have tried other solutions of copper, such as the nitrate; but although the process is hastened, the metal is apt to be brittle, or to have other imperfections.

When engraved plates are to be copied, the first copy is in basso relievo, and therefore a second is required to be made, which is in "intaglio," and then ready for printing. Copies may even be taken of non-conducting substances, as wood cuts, &c., by brushing them over with black lead, taking care that the copper wire is in good contact with the plumbago.

The great advantages of this mode of proceeding above all others, are, first, the quality of the copper is far better than when reduced in the usual way, as described by Messrs. Spencer and Solly. This advantage is owing, first, to the use of the copper at the oxygen end, as suggested by Mr. Mason; secondly, all the plates or medals, for there is no limit to the number, are in the same vessel; thirdly, the process may be hurried or retarded, accordingly as the number of plates of the battery are increased or diminished; fourthly, the plates will not require to be interfered with till the precipitation is completely finished; and there are many other more trifling advantages, which it would be tedious to enumerate.

The mode of proceeding here detailed differs but little from others which have been described; but these trifling differences are so important in practice, that this mode will probably supersede every other. In fact, I have had the pleasure of seeing many most valuable copperplates subjected to this process, and the specimen which accompanies this paper is, I believe, the first which has ever undergone the ordeal of having the large number of impressions, required for any publication, printed from it. Of course it is a perfect fac-simile, and therefore this method would be of the greatest importance to bankers for their notes, and is far superior to Mr. Perkins' process for the multiplication of plates, because in that case they almost invariably require to be touched up afterwards, and therefore absolute identity is destroyed. The cost of their manufacture would be trifling, being merely the value of the zinc* dissolved in the battery, and a pound of zinc, of the value of sixpence, would produce a copperplate weighing about two pounds; and I trust that copper will again, from its beauty, take the place of steel engravings.

So much for the precipitation of the copper; and the next thing to which I have to direct your attention, is a mode of making a copperplate engraving without an engraving in the first instance. This is done by drawing upon a smooth piece of copper (such as a plate used for engraving) with any thick varnish or pigment insoluble in water, and then exposing the plate in

* The zinc in the fluid might be precipitated as a carbonate, for which there is great demand in the arts, and thereby the expense of the electrotype would be further diminished.

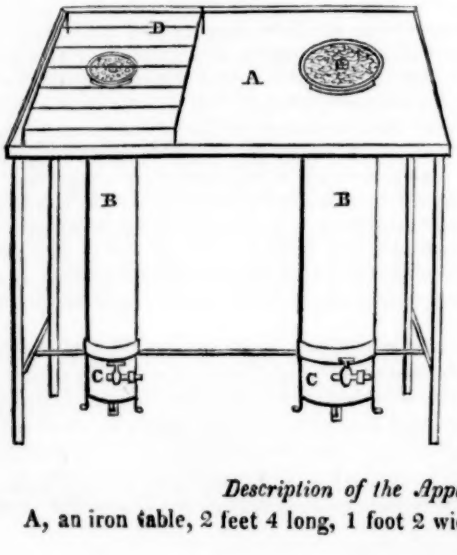
the usual way to the influence of the current, when first copper will be thrown down upon the uncovered parts, and will gradually grow over the drawing, and the electrotype, when removed, will be ready for printing. A practical difficulty, however, arises in the application of this in the arts, for unless very thick oil paint is used, sufficient depth is not obtained to hold the ink. However, judging from the sharpness of the edges of the lines, I have but little doubt that this difficulty may be overcome by those who are accustomed to drawing; and it possesses, as an additional advantage to its cheapness, the valuable property of not requiring the artist to reverse the design. An opposite effect to this may be produced by placing a piece of copper similarly drawn upon at the oxygen end of the battery, when the metal will be acted upon, leaving a drawing in basso-relievo.

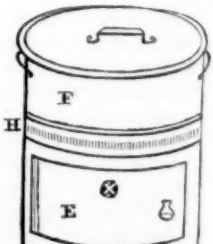
Bank of England, April 21, 1840. Lond. & Ed. Philos Mag.

Ricketts' Gas Cooking Apparatus.

Sir,—I send you herewith a rough sketch of a gas cooking apparatus, made for me by Mr. Ricketts, Agar street, Strand, London, which appears more useful, and certainly very much more economical in use, than the one described by your correspondent Mr. Weller; for I have a round tea kettle with concave bottom, and in this I can boil over my 5 inch burner, 4 quarts of water in 15 minutes, consuming 2 feet of gas, value one farthing. My portable oven will bake as well as any epicure can wish; it will hold 10 lbs. of meat, and the boiler above it 2 fowls and a vegetable tray; it is heated at the same time and from the same burner as the oven, consuming 8 feet of gas per hour; thus cooking a substantial family dinner for about two pence. My smaller burner consumes 3 feet of gas per hour, and this I find very useful for stewing. Yours, most obediently, P. O. Conner.

Dublin, March 25, 1840.





Description of the Apparatus.

A, an iron table, 2 feet 4 long, 1 foot 2 wide, and 2 feet 8 high.

B, B, diluted gas burners for uniting a jet of coal gas with atmospheric air.
C, C, cocks with unions for attaching to the gas supply pipe.
D, iron stand or trivet for stew pans, tea kettle, &c.
E, portable oven.
F, tin boiler, with steam tray inside for vegetables.
G, small wove wire door for lighting burner.
H, fret work between top of oven and bottom of boiler, for escape of heated air.

Lond. Mech. Mag.

Mr. Charles Hancock's new process of Coloured Picture Printing.

We have been much gratified by the inspection of a proof-print of a picture painted, engraved, and *printed in colours*, by a new process, (so as to present a perfect *fac simile* of the original,) by Mr. Charles Hancock, the eminent animal painter. The subject is deer stalking in the Highlands. A huntsman in tartan costume, is about to let slip two magnificent looking staghounds, in pursuit of a herd of deer, seen scampering off in the distance, along the base of a range of precipitous cliffs, just lit up by the rays of the morning sun. A subject better calculated to show off the merits of the new process—from the great variety of bright colouring which it embraces—could scarcely have been selected; and in point of execution, it does, in every respect, great credit to the talents of the artist. The change from colour to colour, and the gradations of tint in each colour, are effected with as nice a resemblance to nature as if they had been done, not by a machine, but with infinite skill by the hand and brush. Indeed no person could, from mere inspection, discover any difference.

The process by which this important result has been obtained, and for which Mr. Hancock has procured letters patent, we shall now very briefly describe.

An outline is first etched and transferred to as many plates as there are positive colours in the picture, and any required gradations of light and shade in each colour, are produced upon the plate assigned to that colour, which is done by any of the ordinary modes of engraving. The different plates are then printed from in succession, with the colours appropriate to each, the chief care required being that of adjustment, so that one impression shall not, in the slightest degree, overlay another.

To the publishers of prints, this process is of great and manifest advantage. Two or three engravers can, by means of it, work simultaneously from the same picture, and a greater number of copies can be produced in a given time than has ever hitherto been done by any other process—much better copies too, inasmuch as prints coloured after nature are superior to prints in the ordinary black and white (supposing both to be equally well printed.) The cost of each series of plates is not more than that of one plate engraved in the usual way, (the metal only excepted) while against the extra expense of working there is to be set the entire saving of the print colourer's bill, for daubing in the wretched flare-up style which the shop windows have made familiar to the public.

This process will probably be found equally valuable to some of our manufactures—in the ornamenting of china for example; paper-hangings, cottons, silks, and other useful and ornamental fabrics; particularly as the process can be applied to surfaces engraved in relief, and printed at a type press, as well as to the ordinary modes of copperplate engraving and printing.

Ibid.

NOTICES FROM THE FRENCH JOURNALS. TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE, BY J. GRISCOM.

Portable Match-bougies.

M. Chaussard, one of the most industrious gilders of the Capital, (Paris) has just patented a charming little affair which must soon come into general use, for it will be as convenient an article to the workman, the artist and the gentleman, as to people of fashion. It consists of a small case, not more than half an inch in diameter and three inches long, and of course as easily carried in the smallest pocket and held in the fingers as the most delicate snuff box. Within is a quantity of phosphoric matches and of little bougies. You take off the cover, hold it between the fore and middle fingers, take out a bougie, place it in a little opening in the cover which supports it, then draw out a match, rub it lightly on the case, the end of which, carved into concentric circles, produces a friction that kindles it. The bougie is lighted and the case being closed, you hold in the hand a veritable little wax candlestick, with a light which will burn for five minutes, and of course long enough to go up stairs and to light up a room, to read a letter, which any one may hand you of an evening in the street, to hunt for an object dropped in a dark place, to render assistance in an infinity of cases in domestic life when a light is suddenly wanted,—in a carriage, in a stage, to kindle a fire, light a candle, &c. &c. If both hands are wanted for any of these purposes, the match case may be placed on the floor, on a table, or in the chimney, and it stands quite secure. The price of these little utensils is very moderate, and within the reach of all. Rec. Soc. Polytech. Jan. 1840

(We have not seen any of these handy little affairs, but trust it will not be long before they will be common in our shops. Trans.)

Interesting Facts in Acoustics.

M. Jobard, a skilful artisan, states the following fact:

"An iron rule of considerable size, was left by chance resting on a bladder partly filled with gas in my laboratory. I happened to hit it in passing, with a hard body, and was surprised at the long continuance of the sound which escaped from it.

I repeated the experiment, and ascertained that a metallic rule, supported on one or two moist bladders, filled with air or gas, had its vibrations not more rapidly weakened or checked than if it had been freely suspended in space.

We may even derive from it various kinds of sounds, by varying the intensity and place of the strokes.

Other occupations have prevented me from pursuing the experiments. I suppose that a metallic organ key, (clanier) supported by two thin tubes of caoutchouc, filled with air, would give the same results as a piano à cordes, and that it would better preserve its accordance." Ibid.

Absolute Alcohol.

M. E. Soubeiran, at the conclusion of an article on the rectification of alcohol, gives the following direction:

"If you wish to obtain absolute alcohol easily, abundantly, and economically, it must be first rectified over carbonate of potash, which will bring it to 94° or 95°, thus:

1. Bring it to 97° by distilling it with 100 grammes (= 155 grs. troy) per quart of fused chloride of calcium, or, letting it digest on 2325 grains per quart of quick lime, in a warm place for two or three days, and then distil slowly from 3875 grains per quart of quick lime.

2. Add to the alcohol at 94°, 7750 grains troy per quart of quick lime; leave them in contact two or three days in a warm stove, and then distil slowly. The lime communicates to the alcohol no unpleasant taste or odour, as some have imagined and written; that happens only when the alcohol has not been previously rectified.

After this has been done over the alkaline carbonate, such an effect need not be apprehended, and the alcohol obtained has all the qualities that can be desired."

Jour. de Pharm. Jan. 1839.

On the influence of native Magnesia (Giobertite) in the germination, vegetation, and fructification of Plants. By Angelo Abbene.

It has been thought that the presence of magnesia may be numbered among the various causes which render land sterile, because it has been remarked that magnesian soils have an arid character. This opinion has begun to lose credit since Bergman, on examining the composition of fertile soils, considered magnesia as one of their principal constituents.

Professor Giobert has made many trials to discover the parts which the native magnesia acts that is found in several arable lands. In the vicinity of Castellamonte and Baldissero, this substance is abundantly diffused, in soils which are cultivated with great success, and on which a vigorous vegetation prevails. There are many localities in Piedmont and other places, where the double carbonate of lime and magnesia abounds in cultivated territories, which produce beautiful crops. Giobert has inferred from these experiments, 1st, that native carbonate of magnesia is not adverse to the fruition of plants; 2nd, that in consequence of the solubility of the magnesia in an excess of carbonic acid, the earth may exert an action analogous to lime; 3rd, that a magnesian soil may become fertile when used with the needful quantity of manure employed.

The consequence which naturally flows from these facts is, that the magnesia has been dissolved in an excess of carbonic acid and water, and enters, like lime, into the composition of the sap, and ought to be found in the plant like potash, lime, oxide of iron, &c. This M. Abbene has assured himself of by the analysis of the ashes of plants which vegetated in magnesian mixtures. He has also tried by comparative experiments the question, whether the influence of magnesia in vegetation is analogous to that of lime. The conclusions which he thinks are deducible from these trials are:

1st. Native magnesia is not unfavourable to the germination, vegetation, and fructification of plants, but appears favourable to these functions.

2nd. Magnesia, being soluble in an excess of carbonic acid, exerts an action similar to lime, and when a soil contains magnesia not sufficiently carbonated, a remedy is found in the addition of manure, which, by its decomposition, furnishes the needful carbonic acid. The amelioration will be the more efficacious if the land be well stirred up, because the air will then better perform its office.

3rd. When in arable soils both lime and magnesia exist, the first is absorbed in preference by plants, because it has a greater affinity for carbonic acid.

4th. In sterile magnesian soils, it is not to the magnesia that the sterility is to be attributed, but either to the cohesion of their parts, to the want of manure, clay, or other ingredients, to the great quantity of oxide of iron, &c.

5th. Sterile magnesian soils may be fertilised by means of calcareous substances, such as plaster, chalk, ashes, marl, &c., provided the other conditions are attended to. Ibid.

Dilatation of Oils. By Prof. F. Preisser, *of Rouen.*

On the 27th of March, 1838, M. M. Levavasseur Frères, of Rouen, foreseeing a rise in the price of oil, purchased a quantity, partly of seed and partly of fish oil, amounting to 4232 hectolitres, which were stored in the magazines. On the 14th of July the Octroi took a fresh account of the oil, and found that instead of 4232 it amounted to 4279, hectolitres 40 litres.—Granting 30 hectolitres 40 litres for inevitable loss and waste, there remained 17 hectolitres (about 450 gallons) which could not be accounted for, and these merchants were accused by the Octroi of a fraudulent introduction of this excess.

Prof. Preisser being consulted on the case, he undertook an investigation of the amount of dilatation which oil undergoes by a given rise of temperature. He found, by several methods of trial, that in rising from the freezing to the boiling temperature of water, olive and linseed oil expands one part in 1200, and whale oil one part in 1000. Neats foot oil expands one part in 980, oil of colza one in 1120, nut oil one in 1100, and white oil one in 1250.

Thus it appeared, that in taking into account the mean difference in atmospheric temperature between the time of storage and subsequent measurement of the oil, the quantity in excess was at once accounted for by the natural expansion of the mass.

The calculation for finding the increase of volume of any number of hectolitres (and of course other measures) for a given difference of temperature, is extremely easy: it is only to divide the number of measures by the coefficient of increase, stated as above, for one degree of temperature, and to multiply the quotient by the number of degrees constituting the difference of temperature.

The above facts show the imprudence of completely filling barrels with oil in winter, and leaving them unmoved through the summer. The oil must necessarily find its way through the joints of the casks, or otherwise burst the containing vessel.

The same principle is applicable to other liquids. The coefficient for alcohol is $\frac{1}{909}$.

By attending to these facts, errors of opinion, and perhaps expensive lawsuits, may be avoided. Idem, Fev., 1839.

Development of Odours.

Every one is acquainted with the rotation which a piece of camphor undergoes in water, and the explanation of the fact which usually ascribes it to the

disengagement of the odorant vapours which exhale from it. It is known also that the leaves of the *schinus molle* placed on water, forcibly retract when the surface of the water is covered by a layer of odoriferous oil. M. Morren has just observed a similar phenomenon produced by the volatile oil secreted by the down of the *passiflora fœtida*. When some of the down or hair is placed under water, a small drop of green oil detaches from it, and swims on the water. This drop expands, contracts, expands, contracts again, then seems to burst with force, but the fragments unite to expand again a moment after, and thus the action goes on for about ten minutes, after which the oil is by degrees concentrated, and becomes motionless. These facts may serve, perhaps, to point out a physical theory of odours.

Idem, Avril.

Easy preparation of Anhydrous Phosphoric Acid. By Richard Felix Marchand. (*Journ. für Praktische Chemie.*)

In a large porcelain dish place a small support, surmounted by the cover of a crucible, or a little porcelain capsule. Put into this capsule a few pieces of dry phosphorus, and place over it a large bell glass, with an opening at top, stopped by a cork, through which passes two tubes, the one large, and extending down almost to the capsule. It may be closed at top by a cork; the other narrow, and bent at an angle on the outside.

This narrow tube is to be connected with an apparatus for preparing oxygen gas—a retort in which chlorate of potash is heated, is perhaps preferable—though the most desirable mode is to cause it to issue from a gasometer, and to dry it completely by passing it over chloride of calcium and sulphuric acid. The oxygen gas must first be passed in, so as to expel the atmospheric air; then inflame the phosphorus, by passing a hot iron rod down the large tube. When all the phosphorus is burnt, more may be passed down the tube into the little capsule. The retort may be easily changed when all the chlorate of potash is decomposed. When the bell glass becomes too hot, the operation must be stopped till it cools, otherwise it will inevitably break. In this way, a very considerable quantity of the acid, almost pure, may be made in a very short time. With a quarter of a pound of phosphorus I have made more than half a pound of anhydrous acid. When the combustion is well managed, scarcely any vapours are disengaged. The flakes of acid attached to the bell glass and capsule may be quickly removed by a spoon. It must be preserved in well closed bottles.

Idem, Juin, 1839.

Rock Crystal Spun. By M. Gaudin.

M. Gaudin sent to the Academy of Sciences, at the last (April) session, specimens of rock crystal, which he had succeeded in melting and drawing out into threads several feet in length, with the greatest ease. One of these can be wound into a skain, and the other wound round the finger.

M. Gaudin has found also, that melted rock crystal moulds easily by pressure, and that it is very volatile at a temperature a little above its melting point. Alumin acts very differently from silica; it is always perfectly fluid, or crystalized, and cannot be brought to a state of viscosity; while viscosity, separate from all tendency to crystalization, is the permanent condition of silica under the oxygen blowpipe. Alumin is much less volatile than silica; it often, however, undergoes ebullition.

In a more recent essay, M. Gaudin has tried the temper and relations of rock crystal, which has afforded unexpected results. If a drop of melted crystal fall into water, far from cracking and flying to pieces, it remains limpid, and furnishes good lenses for the microscope. When struck by a hammer, the instrument rebounds, and the lump will sink into a brick rather than break: its tenacity is such, that pieces can be detached only as splinters. It resembles steel in elasticity and tenacity.

Silicious compounds act nearly in the same way as rock crystal. The sandstone of the pavements spin off like it, with this difference, that its threads, instead of being limpid, are of a pure white, nacreous, silky, and chatoyant, in a singular degree, so that they might be mistaken for silk; and the globules, to a certain degree, have the aspect of fine pearls. There is no doubt that in this way successful means will be employed in producing imitations which will be preferred to natural pearls, since they will possess the hardness of annealed rock crystal, instead of that of a calcareous compound.

The emerald threads perfectly well, and its threads, which scratch rock crystal, are also more tenacious than crystal threads. Idem.

Separation of Lime from Magnesia. *By* J. W. Döbereiner. (*Journ. für Praktische Chemie.*)

If anhydrous chloride of magnesium be treated in contact with air, oxygen is absorbed, and the chlorine abandoned. This decomposition, that is, the transformation of chloride of magnesium into magnesia, is now prompt and complete when chlorate of potash is used instead of air.

This property renders the separation of lime from magnesia very easy. Dissolve the compound of these two bodies (e. x. *dolomite*, &c.) in hydrochloric acid; evaporate to dryness; heat the dried mass in a platina capsule till the acid vapours clear, and add to it, urging the heat to commencing redness, small portions of chlorate of potash, until there is no further disengagement of chlorine. The remaining mass is then composed of chloride of calcium, magnesia, and chloride of potassium, the separation of which is easily effected by treating the mixture with water, filtering the solution, precipitating the filtered liquor by carbonate of soda, &c.

Idem, Juillet, 1839.

Fabrication of Flint and Crown Glass.

On the 27th of January last, M. Bontems, director of the glass works at Choisy-le-roi, read to the Academy of Sciences a memoir, in which he described the process by which he succeeds in making flint glass and crown glass, exempt from streaks and bubbles, and perfectly white, (clear?)

M. Guinand had before succeeded in making flint glass without striæ, by working (brassant) the melted glass into a perfectly homogeneous mass. He accomplished this by means of cylinders of refractory earth, like that of crucibles. These cylinders, closed at bottom, were open at top, so as to receive forked iron rods, with which the mass of melted glass could be stirred as long as necessary, fresh rods being used as they grew hot. M. Guinand had thus resolved a part of the important problem of the fabrication of optical glass, but he left some of its elements in uncertainty. Guided by the experience of this skilful manufacturer, M. Bontems discovered that in making flint and crown glass, the absence of bubbles depends on the pro-

portion of the elements of the glass, and the arrangement of the fire toward the end of the operation. Thus far, also, fluid glass had attained a density of only 3.2 without injuring its clearness, (blancheur) while he has been able to give it a density of 3.6, and as clear as the most beautiful crystal; and crown glass as clear as that of Saint-Gobain or Saint Quirin. He is preparing also to furnish opticians with disks of flint glass and of crown glass, of 40, 50, and even 60 centimetres (=2 feet nearly) in diameter. He appends to his memoir a plan of his ovens and crucibles, and points out all the details of his process.

Idem, Mars, 1810.

On the Precipitation of Gold. By A. Morin, *of Geneva.*

Whenever gold is dissolved for any purpose in the arts, a notable portion of it remains in the mother waters, and various means have been recommended for extracting it. The principal substances used for this purpose are sulphate of iron, and formic acid, or the formiates of potash and soda.

Though the sulphate of iron is a low priced substance, compared with the formiates, the value of the metal is such, that the materials of higher price would be unhesitatingly employed, if they would extract the gold more completely. It may be interesting, therefore, to the workers in the metal, to know the comparative value of the two processes most generally recommended for its precipitation. I have attempted to resolve this question by treating the mother waters resulting from some preparations of this metal.

They were divided into two equal parts, each weighing a kilogramme, ($2\frac{1}{4}$ lbs. nearly) and as each contained a little more than two grammes (30.88 grains troy) they represented a solution of $\frac{1}{450}$ of the metal.

Into one I poured concentrated formic acid, until it acquired a decided acidity. The colour became a fine deep yellow. No gold was precipitated, even when heated. The formiate of potash tried with a small portion of this liquid diluted, showed no reaction. It was only when the liquid was half evaporated that metallic spangles appeared on the surface.

The addition of a few drops of caustic potash increased the quantity, and it was added as long as it increased the precipitate, which had the appearance of dark flocculi mixed with metallic spangles. It was soon deposited. The liquid was neutral and of a green colour. The farther addition of caustic potash gave no precipitate, and formic acid only changed the colour to a deep yellow. A fresh concentration produced no separation of the metal. The precipitate, washed and dried, was black. Heated to redness, it soon assumed the golden lustre. Its weight was 1.535 grammes. The washings and the mother waters were then mixed with a solution of sulphate of iron. An abundant black precipitate was formed, which I treated with muriatic acid with heat. It became of a clear brown, and very light. Adding more sulphate of iron, metallic spangles were formed, and it was continued till nothing more appeared. The deposit, washed with warm water, and then with acid, was dried and heated. It had the metallic splendour, and weighed 0.717 grammes, about one-half the preceding. United to the former, the weight was 2.252 gr.

This essay might appear sufficient to prove the superiority of sulphate of iron over the formic compounds; but I nevertheless tried the direct action of the sulphate on the other portion of the liquid, first acidulating it with muriatic acid, and heating it. The sulphate of iron was added as long as any precipitate appeared. At first violet, it passed to a clear brown. The pre-

cipitate was separated from the supernatant liquid, washed with water and muriatic acid, dried and reddened. It weighed 2.880 grs., sensibly equal to the two other precipitates.

The mother waters and the washings created were treated with formiate of potash, which occasioned no precipitate, even on the concentrated liquid.

These trials prove—

1st. That formic acid precipitates gold only when evaporated, so that the solution contains at least $\frac{1}{333}$ of gold.

2d. That the formiate of potash does this better than formic acid alone.

3d. That formiate of potash separates from a concentrated solution only about $\frac{2}{3}$ of its gold.

4th. That sulphate of iron precipitates completely from liquids containing only $\frac{1}{450}$ of gold.

Sulphate of iron, therefore, is complete, more easy, and more economical. Two precautions are nevertheless necessary for complete success—the use of heat and a notable addition of muriatic acid. Heat gives cohesion to the precipitate, which facilitates its separation. The acid accelerates the action of the sulphate of iron. Idem, Fev., 1840.

Phenomena observed with respect to Carbonic Acid, subjected to pressures superior to that of the Atmosphere. *By* M. Couerbe.

Water, at common temperature and pressure, dissolves about its volume of carbonic acid; and if the pressure is increased, the absorption is also; a volume of gas for each atmosphere, so that by means of a manometer, we learn the state of the interior of the vessel. The law, however, does not hold good for all pressures, and even at 5 volumes, the indicated pressure is often 7, the temperature being 15°, so that, in fact, a term must be arrived at in which the liquid must lose its solvent power, and the gas become nearly ready to assume the liquid state.

It follows, that gas, compressed over a given liquid, undergoes variable pressures, which are not always correspondent with the number of volumes dissolved. The nature of the liquid also causes a variation in the results.

The trials which I have made to come at a knowledge of the phenomena, were practised upon champagne bottles, in good condition, and which support about 20 atmospheres, a sufficient guarantee against fracture;—and yet, when wine ferments in them, we are struck with the damage which takes place in the course of a month, amounting, in the experience of some champagne merchants, to 15, 20, 30, 40, often 50, and even 60 per cent. Place a manometer, however, in connexion with the resisting bottles, and it scarcely ever indicates more than 7 atmospheres. The fracture, therefore, must be due to some other cause than pressure, or that the tension of the gas, for reasons I am about to furnish, suddenly increases, and transcends 20 atmospheres, the cohesive force of the glass.

Observation has proved to me, that in this liquid, the internal tension is very strong when it contains a little more than 5 volumes of carbonic acid; that even at 3 to 4 vols. it is great, and that between 4 and 5 vols., the bottles never break. The manometer indicates 7 atmospheres.

The cause of this appears to me to be attributable to the dissolving power of the liquid for the gas, which is variable at each pressure. The tension will be the more feeble as the affinity of the water for the gas is greater. Hence in a mixture of liquid and compressed gas, there are two forces in operation, the force of solution and the force of tension. When 3 or 4 vol-

umes are dissolved, the soluble force is weak, and cannot overcome the tension of the gas; at 4 to 5 volumes, the pressure is sufficient to bring the affinity of the liquid for the gas to its maximum, and to give the latter a tension equal to 7. At 5 volumes and more, the solvent power diminishes; the tension increases, surpasses the cohesion of the glass, which is equal to 20 atmospheres, and breaks it. These singular results seem foreign to all that has hitherto been known relative to the solution of gases in liquids.

It is proper, however, to notice what M. Soubeiran has said in his work on gaseous acidulated waters: "One fact worthy of remark, is, that notwithstanding the bad quality of the products, the gas contained in the bottles is sufficient to expel the corks to the end of the experiments, and yet, when we come to examine the liquid, we find but a small quantity of carbonic acid in it." This fact appeared to M. Soubeiran an anomaly, and he endeavours to explain it by saying: "The operator, by his dexterity, was enabled to enclose a portion of gas in the neck of the bottle, which accumulates there with sufficient intensity to drive out the cork, but there was no coincidence between the volume of gas retained in the water and that of its superior atmosphere."

The various phenomena above presented, may be assimilated to examples of another kind—the solution of salts in water. It is known that sulphate of soda is more soluble at 40° than at 20°, at 60°, &c., so that a line may be traced in a diagram through points which indicate the quantity of salt dissolved, and the temperature—a line which chemists call the *curve of solubility*. In the same way in the phenomena of gases, I think that a careful series of experiments might establish a curve of solubility of gases in liquids at given degrees of pressure, and that these apparently contradictory facts might be reduced to general laws. Thus the pressure over a solution of carbonic acid gas in certain liquids, acts absolutely like heat in a solution of salts in water—a correspondence which appears to me to be demonstrated by the experiments above detailed.

In the work referred to, M. Soubeiran gives a table of experiments which shows that agitation increases the tension of the gas; the difference is particularly marked at the beginning of the operation. "The agitation of the liquid," says the author, "constantly increases the pressure of the gas at the surface, and causes the water to lose a portion of the gas it held in solution." I may mention, that I made more than fifty experiments with bottles of champagne at 5 volumes, and that the manometer, which indicated 7 atmosperes, did not vary a demi-millimetre—therefore, if the observation of M. Soubeiran can be relied upon, the empty space modifies the phenomena according to its variable extent or dimensions. I say the empty space, because the experiments of Soubeiran were made with casks of 30 gallons of water, charged with 4 volumes of carbonic acid gas, and having a void space of 2½ gallons at the surface.

In general, when a liquid like water contains several volumes of carbonic acid in consequence of increased pressure, the gas escapes almost instantly, as soon as the pressure is relaxed, and the liquid retains about a single volume; but champagne wine acts differently. As soon as the cork is withdrawn, about half a volume of gas escapes immediately, and the disengagement continues slowly till it amounts to a volume, and then stops; when a bottle may be left long uncorked without a total loss of gas. I am now supposing that the wine has been well prepared, and somewhat dried by tannin. This singular fact is owing to organic matter extending, in a kind

of network, through the vinous mass, and which condenses and retains the gas precisely like certain powders, and a great number of porous bodies, even under the common pressure of the atmosphere.—*Actes de l'Academie Royale des Sciences de Bourdeaux*, 1839. Idem.

LUNAR OCCULTATIONS FOR PHILADELPHIA, OCTOBER, 1840.

Angles reckoned to the right to westward round the circle, asseen in an inverting telescope. ☞ For direct vision add 180° ☜

Day.	H'r.	Min.	Star's name.	Mag.	From Moon's North point.	From Moon's Vertex.
6	8	33	Im. d^3 Capricorni,	6	144°	151°
6	9	53	Em.		285	301
13	6	50	Im. *s* Pleiadum,	3	51	4
13	7	16	Em.		343	296
13	7	36	N. app. ☽'s limb 2'.2 N. of *h* Pleadium,	5,6		
16	16	19	Im. A Geminorum,	6	68	24
16	17	40	Em.		262	270

Meteorological Observations for May, 1840.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
⊗	1	56	66	29.60	29.56	W.	Brisk.	.05	Cloudy—showery.
	2	46	60	.70	.70	W.	Moderate.		Clear—do.
	3	50	74	.70	.70	W S.	do.	.03	Clear—rain.
	4	66	72	.20	.20	W.	Brisk.		Flying clouds—do. do.
	5	48	57	.46	.54	W.	do.		Flying clouds—do. do.
	6	44	58	.80	.80	N W.	do.		Clear—do.
	7	42	63	.80	.80	W.	Moderate.		Clear—do.
☾	8	43	66	.87	.87	N.E.	do.		Partially cloudy—do. do.
	9	42	43	.60	.56	E.	Brisk.	.90	Rain—do.
	10	40	48	.60	.66	N	Moderate.	.05	Rain—cloudy.
	11	41	63	.80	.81	N.W.	do.		Clear—flying clouds.
	12	46	73	.83	.90	W.	do.		Clear—do.
	13	46	71	.90	.66	N.W.	do.		Clear—do.
	14	46	77	30.05	30 00	N.W.	do.		Clear—do.
☿	15	55	78	29.86	29.80	S.W.	Brisk.		Lightly cloudy.—do do.
	16	58	79	.95	30.00	W	Moderate.		Fog— lear.
	17	56	84	30 10	.06	W.	do.		Clear—do.
	18	62	85	.00	29.94	S.W.	do.		Clear—flying clouds.
	19	62	80	29.90	.87	S.W.E.	do.		Clear—flying clouds.
	20	54	58	.90	.80	N.E.	do.		Cloudy—rain.
	21	56	62	.60	.60	N.E.	do.	1.10	Rain—do.
	22	56	72	.70	.80	W.	do.		Partially cloudy—clear.
	23	52	78	.90	.9[illegible]	S E.	do.		Clear—lightly cloudy.
☽	24	56	62	30.05	.15	E.	do.	.45	Rain—do.
	25	57	75	.27	30.27	E.	do.		Cloudy—clear.
	26	49	75	.20	.15	E.	do.		Clear—do.
	27	52	81	.01	29.96	S.W.	do.		Clear—lightly cloudy.
	28	58	82	29.72	.75	S W.	do.		Clear—flying clouds.
	29	60	85	.70	.65	S.S.E.	Calm.		Cloudy—clear.
⊗	30	53	73	.70	.72	E.	Moderate.		Clear—partially cloudy.
	31	62	83	.72	.72	W.	do.		Cloudy—clear.
	Mean	52.22	70 42	29.81	29.77			2.58	

Thermometer.			Barometer.	
Maximum height during the month.	85 00	on 18 and 29th.	30.27 on the 25th.	
Minimum " "	40 00	on 10th.	29.15 " 21th.	
Mean	6[illegible].32		29.84	

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

AUGUST, 1840.

	County.	Town.	Observer.	Thermometer.										Barom			
											Register.						
				7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Lowest.	Mean.	Days omitted.	7, A. M.	2, P. M.	9, P. M.	Maximum.
1	Philadelphia,	Philadelphia,	J. M. Hamilton,	74.47	78.85	70.96	86.00	66.00	74.76	3	60.00	64.17	3	30.11	30.09	30.08	30.45
2	Montgomery,																
3	Bucks,	Newtown,	L. H. Parsons,	71.63	80.67	66.30	88.00	47.00	72.87	.	51.00	59.32	.	30.01	29.99	29.97	30.35
4	Lehigh,																
5	Northampton,	Easton,	Charles Elliot,	65.74	70.00	67.57	83.00	57.00	67.77	1	....	....	.	29.93	29.91	29.91	30.30
6	Monroe	Stroudsburg,	A. M. Stokes,	66.65	81.05	70.20	88.00	50.00	72.63	11½ obs.	....	....	.	29.58	29.60	29.55	29.90
7	Pike,	Milford,	Ralph Bull,	60.80	78.90	62.50	87.00	51.00	67.40	.	50.00	57.68	.	29.58	29.55	29.57	29.93
8	Wayne,	Honesdale,	W. Richardson,														
9	Susquehanna,	Silver Lake,	E. Rose,														
10	Luzerne,	Wilkesbarre,	W. F. Dennis,														
11	Schuylkill,	Port Carbon	John G. Hewes,	64.27	80.81	66.25	90.00	54.00	70.44	1	52.00	60.30	1	29.35	29.34	29.36	29.98
12	Berks,	Reading,	C. F. Egelmann,	69.10	78.06	68.35	84.00	60.00	71.84	.	...	...	.	29.88	29.87	29.86	30.20
13	Chester,	West Chester,	Wm. W. Jefferies,	72.46	80.38	76.92	87.25	65.00	76.59	.	59.50	69.40	.	30.64	30.64	30.64	30.84
14	Delaware,	Haverford,	Haverford School,	69.87	79.68	68.06	86.00	60.00	72.54	obs.	54.00	60.30	obs.	29.56	29.56	29.56	29.90
15	Lancaster,	Lancaster,	Conservatory of Arts,	69.15	81.57	70.61	89.00	59.50	73.78	obs.	55.00	65.99	.	29.52	29.50	29.51	29.87
16	York,																
17	Lebanon,																
18	Dauphin,	Harrisburg,	J. Heisely,	71.65	79.90	75.94	86.00	64.00	75.85	.	60.00	68.35	.	29.75	29.73	29.71	30.05
19	Northumberland,	Northumberland,	Andrew C. Huston,	68.68	77.44	70.77	85.00	60.00	72.30	.	49.00	59.23	.	29.49	29.47	29.47	29.84
20	Columbia,	Danville,	C. H. Frick.														
21	Bradford,																
22	Tioga,																
23	Lycoming,																
24	Union,																
25	Mifflin,																
26	Juniata,	Mifflintown,	J. A. Rinkead,	61.94	81.63	66.94	92.00	53.50	70.17	5½ obs.	....	....	.	29.51	29.43	29.49	29.84
27	Perry,																
28	Cumberland,	Carlisle,	Prof. W. H. Allen,														
29	Adams,	Gettysburg,	Prof. M. Jacobs,	67.39	80.58	70.35	86.50	59.00	72.77	.	51.00	62.55	.	29.43	29.40	29.41	29.73
30	Franklin,																
31	Huntingdon,	Huntingdon,	Jacob Miller,	67.87	83.03	69.45	91.00	55.00	73.45	.	....	....	.	29.38	29.35	29.36	29.69
32	Centre,	Bellefonte,	John Harris,	63.83	78.97	66.96	86.50	52.50	69.92	7	....	....	.	29.30	29.31	29.38	29.64
33	Potter,																
34	M'Kean,	Smithport,	Richard Chadwick,	61.23	75.55	56.87	86.00	48.00	64.55	.	41.00	53.00	.	28.06	28.07	28.03	28.25
35	Clearfield,																
36	Cambria,	Ebensburgh,	Richard Lewis,	63.13	76.72	62.87	86.00	49.00	67.57	2⅔	44.00	56.45	2	27.96	27.93	27.94	28.22
37	Bedford,	Bedford,	Samuel Brown,	70.87	78.68	74.15	87.20	60.50	74.57	.	....	....	.	29.26	29.24	29.26	29.55
38	Somerset,	Somerset,	George Mowry,	63.65	73.52	63.64	82.00	52.00	66.94	.	46.00	58.34	.	28.00	28.00	28.00	28.29
39	Indiana,	Indiana,	Richard White,	72.94	77.74	66.00	85.00	58.00	72.23	.	39.00	49.87	.	28.68	28.67	28.65	29.00
40	Jefferson,	Rose Cottage,	C. C. Gaskell,														
41	Warren,	Warren,	C. S. Brown,	65.82	73.62	71.38	82.00	55.00	70.27	6⅔	55.00	65.25	7	28.83	28.81	28.83	29.20
42	Venango,	Franklin,	Wm. Connely,	59.97	82.81	68.26	94.00	48.00	70.35	.	....	....	.	29.10	29.11	29.04	29.90
43	Armstrong,																
44	Westmoreland,																
45	Fayette,	Uniontown,	J. P. Weithers,	68.87	83.58	69.34	94.00	54.00	73.93	.	....	....	.	28.99	29.00	29.01	29.30
46	Green,																
47	Washington,	Cannonsburg,	A. H. Campbell,	66.29	78.78	70.13	86.00	52.00	71.73	.	49.00	61.03	.	29.10	29.07	29.09	29.36
48	Alleghany,	Pittsburgh,															
49	Beaver,	Beaver,	Wm. Allison,														
50	Butler,	Butler,	Jacob Mechling,	66.26	77.48	71.32	86.00	52.00	71.69	.	....	....	.	28.84	28.84	28.84	29.10
51	Mercer,	West Greenfield,	S. Campbell,														
52	Crawford,	Meadville,	J. Limber,	68.97	77.21	68.48	92.00	60.00	71.55	1⅔	52.00	66.62	2	28.78	28.78	28.77	29.08
53	Erie,	Erie,	Park & Reid,														

of network, t
gas precisely
even under th
Royale des Sci

LUNAR OCCU

Day.	H'r.	Min.
6	8	33
6	9	53
13	6	50
13	7	16
13	7	36
16	16	19
16	17	40

Moon.	Days.	The Sun rise.
⊗	1	56
	2	46
	3	50
	4	66
	5	48
	6	44
	7	42
☾	8	43
	9	42
	10	40
	11	41
	12	46
	13	46
	14	46
	15	55
☉	16	58
	17	56
	18	62
	19	62
	20	54
	21	56
	22	56
	23	52
☽	24	56
	25	57
	26	49
	27	52
	28	58
	29	60
	30	58
⊗	31	62
	Mean	52.22
Maximum height		
Minimum		
Mean		

Thermometer.									Barometer				
					Register.								
2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Lowest.	Mean.	Days omitted.	7, A. M.	2, P. M.	9, P. M.	Maximum.	
78.85	70.96	86.00	66.00	74.76	3	60.00	64.17	3	30.11	30.09	30.08	30.45	29
80.67	66.30	88.00	47.00	72.87	.	51.00	59.32	.	30.01	29.99	29.97	30.35	29
70.00	67.57	83.00	57.00	67.77	1	....	....	.	29.93	29.91	29.91	30.30	29
81.05	70.20	88.00	50.00	72.63	11½	....	....	.	29.58	29.60	29.55	29.90	29
78.90	62.50	87.00	51.00	67.40	.	50.00	57.68	.	29.58	29.55	29.57	29.93	29
80.81	66.25	90.00	54.00	70.44	1	52.00	60.30	1	29.35	29.34	29.36	29.98	29
73.06	68.35	84.00	60.00	71.84	.	...	...	.	29.88	29.87	29.86	30.20	29
80.38	76.92	87.25	65.00	76.59	.	59.50	69.40	.	30.64	30.64	30.64	30.84	30
79.68	68.06	86.00	60.00	72.54	½	54.00	60.30	½	29.56	29.56	29.56	29.90	29
71.57	70.61	89.00	59.50	73.78	½	55.00	65.99	.	29.52	29.50	29.51	29.87	29
79.90	75.94	86.00	64.00	75.85	.	60.00	68.35	.	29.75	29.73	29.71	30.05	29
77.44	70.77	85.00	60.00	72.30	.	49.00	59.23	.	29.49	29.47	29.47	29.84	29
71.63	66.94	92.00	53.50	70.17	5½	....	....	.	29.51	29.43	29.49	29.84	29
70.58	70.35	86.50	59.00	72.77	.	51.00	62.55	.	29.43	29.40	29.41	29.73	29
73.03	69.45	91.00	55.00	73.45	.	....	....	.	29.38	29.35	29.36	29.69	29
68.97	66.96	86.50	52.50	69.92	7	....	....	.	29.30	29.31	29.38	29.64	29
65.55	56.87	86.00	48.00	64.55	.	41.00	53.00	.	28.06	28.07	28.03	28.25	27
66.72	62.87	86.00	49.00	67.57	2⅔	44.00	56.45	2	27.96	27.93	27.94	28.22	27
68.68	74.15	87.20	60.50	74.57	.	....	....	.	29.26	29.24	29.26	29.55	28
71.52	63.64	82.00	52.00	66.94	.	46.00	58.34	.	28.00	28.00	28.00	28.29	27
67.74	66.00	85.00	58.00	72.23	.	39.00	49.87	.	28.68	28.67	28.65	29.00	28
71.62	71.38	82.00	55.00	70.27	6⅔	55.00	65.25	7	28.83	28.81	28.83	29.20	28
68.81	68.26	94.00	48.00	70.35	.	....	....	.	29.10	29.11	29.04	29.90	28
73.58	69.34	94.00	51.00	73.93	.	....	....	.	28.99	29.00	29.01	29.30	28
71.78	70.13	86.00	52.00	71.73	.	49.00	61.03	.	29.10	29.07	29.09	29.36	29
72.48	71.32	86.00	52.00	71.69	.	....	....	.	28.84	28.84	28.84	29.10	28
73.21	68.48	92.00	60.00	71.55	1⅔	52.00	66.62	2	28.78	28.78	28.77	29.08	28

Barometer.					Weather.							Winds.																Hygrometer.					
9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew-point.	Wet Bulb.	Days omitted.	No. of Report.
30.08	30.45	29.79	30.09	2½	24⅔	3⅔	2⅔	....	....	....	..	...	⅔	⅔	1⅔	.	2⅓	⅓	3⅔	1	3½	1⅓	4⅔	.	1⅔	⅔	3⅔	⅓	.	5⅓	....	.	... .	....	.	1183
29.97	30.55	29.71	29.99	.	19⅓	8⅓	3⅓	9	....	....	2	5.549	.	1	1⅔	⅔	⅔	.	2⅓	⅓	2½	⅓	14⅔	.	.	1	4⅔	⅔	.	⅔	....	.	.....	....	.	1276
29.91	30.30	29.59	29.92	3½	.	.	.	....	....	....	..	.... .	.	.	1⅓	.	1⅓	.	2⅔	.	.	.	15⅔	.	2	.	4	.	.	4	....	.	.. ..	....	.	1200
29.55	29.90	29.25	29.58	9⅓	6	14⅓	10⅔	....	....	....	..	2.740	.	.	.	.	.	.	2⅔	.	6	.	1	⅔	10⅓	.	2	.	.	8	....	.	.....	....	.	1195
29.57	29.93	29.23	29.57	.	16⅔	14⅓	.	....	....	....	..	.....	1⅓	.	1⅓	.	2⅓	⅓	1⅔	1	5	1½	7⅓	1⅓	3⅓	.	3	.	1	.	57.55	.	.....	68.32	.	1194
29.36	29.98	29.04	29.35	1	12⅔	17⅓	1	8	....	....	..	5.540	⅓	.	1	.	2⅔	⅓	4⅓	.	1⅓	.	4	3⅓	7⅔	⅓	2⅓	.	2	1	....	.	.....	....	.	1206
29.86	30.20	29.50	29.87	.	18	13	.	....	....	....	..	3.377	.	.	.	.	⅓	.	3⅓	.	4	⅓	6⅔	.	3	4	9⅓	.	.	.	....	.	.....	....	.	1184
30.64	30.84	30.40	30.64	.	.	.	.	....	....	....	..	.....	1	.	2	.	2⅓	.	3⅔	.	6⅔	.	8	.	4⅓	.	3	.	.	.	....	.	.....	....	.	1311
29.56	29.90	29.25	29.56	7	15	9	7	9	....	....	..	3.658	⅔	1⅔	1	.	⅓	⅓	1⅔	⅓	1⅓	4⅔	11⅔	⅓	⅓	.	3⅓	1	1⅓	⅔	65.07	.	.....	....	.	1209
29.51	29.87	29.15	29.51	⅔	18	12⅔	⅓	8	....	....	..	3.010	2⅔	.	1	.	1½	1⅓	2⅔	2⅔	7	2	3	1	3	1	2	⅔	.	⅓	64.46	2	.....	71.98	2	1193
29.71	30.05	29.42	29.73	.	20	11	.	9	. ..	....	7	3.522	1⅓	.	.	.	.	.	5⅔	.	3⅓	.	8	.	5	.	7⅔	.	.	.	62.43	3	.....	....	.	1185
29.47	29.84	29.15	29.47	.	9⅔	21⅓	⅓	9	....	....	6	6.012	2⅔	.	3⅔	.	⅔	⅓	3	.	9	.	1	⅓	5	.	3	⅓	2	.	....	.	.....	72.26	.	1186
29.49	29.84	29.16	29.48	5⅔	10	14⅔	6⅓	....	....	....	..	.....	⅓	.	1⅓	.	⅓	.	2⅓	.	.	.	4	.	⅔	.	2	.	14⅓	5⅓	....	.	.....	....	.	1189
29.41	29.73	29.13	29.42	.	20	11	.	11	....	....	1	2.901	2⅓	.	.	.	.	.	2⅓	⅓	7⅔	2⅓	3	⅔	3⅓	⅔	⅔	⅔	7	.	....	.	.....	....	.	1213
29.36	29.69	29.08	29.36	.	25	6	.	8	....	....	..	3.442	.	.	.	.	12⅓	.	.	.	.	.	.	.	18⅔	.	.	.	.	.	....	.	.....	....	.	1215
29.38	29.64	29.01	29.30	7⅓	10⅔	12⅔	7⅔	5	....	....	..	6.086	2⅔	.	.	.	⅔	⅔	1⅓	⅓	1⅓	.	2⅓	⅓	4	.	4⅓	.	4⅔	10⅓	....	.	.....	....	.	1190
28.03	28.25	27.80	28.05	.	7⅔	23⅓	.	8	....	....	..	5.095	.	.	.	.	⅓	.	1	.	.	.	7⅔	.	20⅔	.	.	.	⅓	1	....	.	.....	71.71	.	1211
27.94	28.22	27.70	27.94	2⅔	9⅔	16⅔	4⅔	5	....	....	2	2.962	.	.	.	.	.	.	2	.	2⅓	.	2⅓	1⅔	11⅓	1	2⅓	.	5⅓	2⅔	....	.	.....	...	.	1197
29.26	29.55	28.98	29.26	.	19	12	.	....	....	....	..	.....	.	.	.	.	.	.	1⅔	3⅔	.	1⅔	9	4⅔	1⅓	6	2⅓	.	.	⅓	....	.	.. .	....	.	1191
28.00	28.29	27.75	28.00	.	12⅓	18⅔	.	3	...	....	6	3.407	.	.	.	.	.	.	1⅔	1⅓	⅓	.	4⅔	3⅓	4⅔	⅔	1⅓	.	12⅔	1	....	.	.....	....	.	1210
28.65	29.00	28.40	28.67	.	14⅓	16⅔	.	5	....	....	5	4.220	.	.	.	.	.	.	5⅓	.	2⅔	.	2⅔	.	7	.	1⅔	.	11⅔	.	....	.	...	....	.	1201
28.83	29.20	28.58	28.82	6⅔	15⅓	9	6⅔	....	....	...	..	.....	⅓	.	⅓	.	.	.	⅔	⅓	.	⅔	4⅓	.	1⅓	⅓	1⅓	.	14⅔	6⅔	....	.	....	....	.	1208
29.04	29.90	28.60	29.08	1⅓	16⅓	13⅓	1⅓	10	....	....	..	5.560	.	.	.	.	.	.	13⅓	.	.	.	4⅔	.	.	.	12	.	.	1	....	.	.....	....	.	1202
29.01	29.30	28.68	29.00	.	24⅔	6	⅓	....	....	....	..	.....	1	.	.	.	.	.	2⅔	.	3⅓	.	16	.	4	.	3	.	1	.	....	.	.....	....	.	1270
29.09	29.36	29.87	29.09	.	5	8	18	9	....	....	..	3.065	⅓	.	1⅔	.	2	.	2	.	⅔	.	6⅓	.	7	.	2⅓	.	⅔	8	65.21	15	.....	71.13	16	1197
28.84	29.10	28.60	28.84	.	.	.	.	9	...	....	2	6.590	.	.	.	.	6	.	⅔	.	1⅓	.	3	.	19⅓	.	⅔	.	.	.	....	.	.....	....	.	1198
28.77	29.08	28.53	28.78	2	12⅓	16⅓	2⅓	9	....	....	2	7.801	2	.	.	.	⅓	.	1⅔	⅓	8	⅔	5	.	7	.	2⅓	.	1	3	....	.	.....	....	.	1199